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Introduction and Survey Method

In 1963 expenditure by manufacturing industry on transport services amounted to £600 million, of which £240 million was the cost of own transport and £360 million payments to professional operators.(1) Clearly when such vast amounts are expended on a service it is desirable to know what transport facilities are at the disposal of industry and what use is made of them. In September 1966 a survey was undertaken to provide information on this subject, and details were collected on such factors as the composition of traders' vehicle fleets and ownership of facilities such as rail sidings and canal berths; annual traffic generated; the criteria for rate setting; and nature and composition of consignments; as well as on modal choice. The full results of this survey are to be published shortly, but it was considered advantageous to release, as a separate report, a summary of some of the more important findings. These relate principally to the factors that determine the distribution of traffic between modes but some of the other features of the enquiry which are likely to be of greatest interest have been included in the present booklet.

The survey, although large enough—in terms of the number of firms and consignments investigated—to give reasonably accurate information on the total transport market and also on the markets for the transport of certain commodities, was not large enough to give accurate results for specific markets e.g., the carriage of consignments of chemicals of over 1 ton for hauls of over 100 miles. It must be remembered, therefore, that the results refer to an aggregation of specific transport markets and do not, therefore, necessarily hold for any one specific market.

It is hoped that the Survey will provide information that will be useful to all persons concerned with the freight transport industry in that it sets out the quality and types of service that are both demanded by manufacturing industry and available to it. The results have been presented in two ways: in Part I, an experimental use of probability analysis has been made to throw light upon the factors influencing the distribution of traffic between modes. This is a complex analysis that allows for the simultaneous inter-action of all factors but it has been treated in a non-technical manner so as to make it available to as wide an audience as possible. In Part II the main factors that influence the distribution of traffic between modes have been considered in the conventional tabular form together with other parts of the survey which are of general interest.

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[1] These figures are based on the provisional results of the 1963 Census of Production.

Technique used

Information on such factors as the size of the firm, its nature of business, transport facilities at its disposal, expenditure on and tonnage shipped by various modes was collected by means of a general questionnaire taken to the firm. The collection of information on modal choice posed, however, greater problems.

A number of studies of demand for goods transport have been made(¹) which have attempted to rank the determinants of demand, but they have usually relied upon asking firms using transport to rank a number of factors in order of importance, and the firms' answers have then been weighted in the final aggregation to take account of size. Such a technique is open to a number of criticisms: firstly, although it can provide very useful information on general transport requirements such as the necessities of reliability and speed, it does not provide information on how important such factors are in determining the use of one mode as opposed to another. Thus, although speed was found in the present survey to be a very important general requirement, if an equally fast service is provided by two modes then speed is not a factor that determines the choice of one as opposed to the other. Secondly, not all factors that determine choice have been taken into account in these studies thus although such factors as ready availability and the performance of ancillary services are adequately covered, others such as the type of commodity being carried, and destination of consignments are not. Thirdly, such studies have treated factors in isolation instead of allowing for the simultaneous inter-action of all factors upon modal choice. The vast majority of firms use a number of different modes with modal choice depending upon such factors as length of haul, destination, commodity and consignment size, as well as the type of factors used in previous studies such as reliability and performance of ancillary services. The determinants of choice, therefore, can only be measured if they are related to a particular consignment or group of consignments. An important part of the Survey, therefore, was devoted to the collection of consignment data(²) from the firms in the sample. Traders were asked to complete special consignment notes that asked questions *inter alia* about the type of commodity, weight, destination, price if transported by a professional operator and mode used: this is information which is common to the records of many firms, but as it was important to ask additional questions it was necessary to complete the notes for a sample of consignments leaving the firm during the Survey period and not retrospectively. The additional questions related to what are frequently referred to as 'special features' attached to consignments e.g. the use of containers, special vehicles, regularity and urgency. By the use of a postcard despatched with the consignment to be filled in by the consignee

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[1] For examples in the U.K. see: Survey of C licensed vehicles by the T.R.T.A. (1959) and Transport Decisions of Certain Firms in the Black Country by W. R. Cook (Journal of Transport Economics and Policy, September 1967).

[2] A consignment was defined as a shipment despatched from the firm to one dropping off point.

it was possible to obtain information on damage and speed of delivery, and by enquiry after the Survey it was possible to establish a record of consignments lost.

The special consignment note, however, did not include two important pieces of information; namely, the cost of carriage by transport on own account and the charge for carriage by alternative modes of transport. Shippers were, of course, not in a position to give the exact cost of sending individual consignments by their own means of transport, so there was the problem of arriving at a method of cost allocation. The least unsatisfactory method that could be established was an average cost per ton measure, so details were collected in the general questionnaire on costs of own transport and tonnages shipped, and costs were allocated to individual consignments on this basis. This method is open to several objections but it did appear to be the one most frequently used by shippers and is, therefore, the important one with respect to modal choice.

As regards the price of alternatives, clearly this is of importance in any demand study for the price of a particular mode is high or low relative to the prices and qualities(1) of alternatives. Two broad approaches to this problem are possible: firstly, one could have obtained quotations for sending particular consignments by alternative modes or asked the shippers to obtain quotations, or secondly, the shippers could have been asked to say what they *thought* would be the charge by an alternative mode without actually obtaining a quotation. In a perfect market the shipper would have a perfect knowledge of prices and there would be no differences in the charges resulting from the two approaches, but in the imperfect market which exists this is not the case, for a shipper might have a completely false impression of prices or even no knowledge at all. It is, however, this second approach which is the important one for a demand study, for it is the subjective assessment of the shipper which determines modal choice. In order to obtain information on this, therefore, a sample of the consignment notes which had been completed was returned to each firm in the Survey with a request for their assessment of the charge for sending the particular consignments by alternative modes.

The importance of the subjective assessment as opposed to objective factual information in modal choice applies to factors other than the charges by alternative modes. Thus the information collected via the consignment notes on journey time and loss and damage does not tell us how important these factors are in modal choice. If, for instance, the shipper considers freedom from damage to be important in his choice of mode he will send consignments that are liable to damage by a mode where they are least likely to be damaged. This will result in the records of the different modes being brought together

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[1] By qualities is to be understood all characteristics of service other than price (or cost of own account transport).

when one considers the transport market as a whole.(¹) The aggregate factual information on damaged consignments sent by different modes will not provide evidence, therefore, on the efficiency of each mode with respect to this factor. In order to obtain information on the importance of these three factors on choice of mode by the shippers several questions were placed in the general questionnaire taken by the interviewers to the firms. These subjective questions related to ready availability, speed(²) and good record with respect to damage and loss, and the shipper was to state if any of these were taken into account in the choice of the main modes he used.(³)

Besides the factors relating to the consignment and the subjective assessments there is a third broad group of factors which determine modal choice and these relate to the firm itself. Clearly the type of transport facilities that it has at its immediate disposal e.g. own or hired vehicles, 'A' contract arrangements, private rail sidings(⁴), its location; and its size(⁵) can all play an important role in the choice of mode by a firm in any particular instance and information on these factors was collected, as mentioned previously, in the general questionnaire.

There are, therefore, three broad groups of factors which bear upon modal choice. Firstly, the completely factual information relating to the consignment e.g. its size, destination, use of container, ancillary service performed; secondly, the subjective assessments of the shipper relating to freedom from loss and damage, speed, ready availability and charges by alternative modes; and thirdly, the factual information relating to the firm itself, e.g. its size and location. Through the information collected in the general questionnaire, the consignment notes and the subsequent survey on charges by alternative modes, it was possible, therefore, to consider the simultaneous inter-action of these factors upon modal choice in a particular instance.

One of the problems, of course, is that many of these variables are inter-related, and one of the purposes of carrying out the type of analysis employed in Part I was to establish the degree of any inter-dependence and take account

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[1] Because different modes tend to specialise in different types of traffic it is difficult to compare their performance under exactly similar conditions.

[2] Speed was divided into three categories:
(a) Speed to meet customers requirements
(b) Speed to keep stock levels low
(c) Speed to ensure high utilisation of vehicles or wagons.
There were, therefore, six subjective questions in all.

[3] It was considered necessary to confine the choice to two in order to prevent the shipper listing factors for the sake of doing it and which probably had no influence on modal choice. It is because of the desire of the shipper to appear efficient in front of the interviewer that one of the reasons for rejecting the methods used in previous demand studies was that they required a ranking of factors by the shipper.

[4] The analysis only considers the decision whether or not to use a vehicle that has already been purchased. It does not consider the decision leading to the purchase of a vehicle.

[5] Size is important because large firms will serve more diverse markets than small and will have, therefore, a greater range of transport requirements.

of it in attempting to determine the influence of the individual factors on the distribution of traffic between modes.

Survey Method

Two surveys were, in fact, carried out; both related to firms in the manufacturing sector but the one was confined to a particular area of the country and the other had no area constraint but was confined to particular commodities. The first survey, called the General Survey, was designed particularly to provide demand information for a Cost Model upon which the Ministry of Transport is currently engaged. This Cost Model, in its preliminary form is devoted to two routes—London to Newcastle and Liverpool to Glasgow—and the General Survey was confined to firms within a catchment area drawn around these two routes. Although this excluded the West Midlands, Wales, the South West and a large part of Scotland, a comparison of the establishments drawn in the Survey with national figures showed that they were fairly representative of industry in the country as a whole.

The grouping of commodities under 13 broad headings in the General Survey was bound to obscure the importance of commodity in modal choice due to the heterogeneity of the groupings. It was decided therefore to consider a number of specific commodities in detail and this formed the basis of the Commodity Survey. The commodities, or rather the industries which produce the commodities, selected for this Survey were meat and vegetable processing (M.L.H. 214 and 218), iron and steel (M.L.H. 311), heavy chemicals (M.L.H. 271), electronics (M.L.H. 364), paper and paper products (M.L.H. 481-3). The iron and steel and heavy chemicals industries were chosen because they are bulk commodities with the latter requiring special transport facilities; the food processing industry because its products are highly perishable and/or require specialised transport facilities; the electronics industry because of the fragility of its products; the paper industry because it is a producer of a homogeneous commodity moving partly for final demand (e.g. writing paper), and partly for intermediate demand (e.g. newsprint).

The number of establishments included in the Commodity Survey was 502 while a further 513 were included in the General Survey. Not all establishments approached agreed to co-operate in the inquiry, however, thus the total on which the Survey results are based is somewhat less than the 1,000 or so originally approached. In fact, some 700(1) satisfactory replies were

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[1] **Response Rates** Of the 513 establishments approached in the General Survey 361 completed questionnaires involving a total of 13,600* consignment notes. Of the 502 establishments in the Commodity Survey 361 also completed questionnaires involving a total of 16,600 consignment notes*. An analysis of non-response showed that the 30 per cent non-response rates had caused no serious biases. The post-card response rate was much lower (25 per cent), but the information sought on costs by alternative modes for 6,500 consignments was given for 5,500 (85 per cent)—an exceptionally high response rate.

*When grossed up to the actual number of consignments despatched during the survey week the total consignments were: General Survey—64,400 and Commodity Survey—141,600.

received and although this presents far too small a sample to permit the results to be grossed up to yield information on the total transport demand by all manufacturing establishments, a measurement of total demand is quite unnecessary for the purpose of the present inquiry, which is, essentially, to throw light on the allocation of demand between different means of transport rather than total demand for each means. Indeed, total demand, in terms of tons moved, mileage performed and so on, in so far as this can be equated with the operations of the suppliers of transport, has already been well documented, for example, in the Ministry's surveys of road goods transport, the Railway surveys of rail wagon movement, the Board of Trade's surveys of coastal shipping traffic.

Presentation of results

The results have been presented in two parts. Part I contains the results of the probability analysis which has been employed to indicate the relative influence of factors on the distribution of traffic between modes. This technique is both complex and experimental, and in order to facilitate interpretation of the results references have been given throughout to relevant sections in Part II and technical details have been confined to an Appendix. In Part II, Chapter I involves a discussion of the main factors influencing the distribution of traffic between modes based upon a conventional tabular analysis; Chapter II deals with other findings of the Survey which, it was thought, would be of greatest interest to the reader.

The reader is reminded that this Report is only a summary and that for more detailed analysis he is referred to the main work.

Part I: The determinants of modal choice—a probability approach

The type of analysis employed(1) in this section has two aims: firstly, to determine the relative importance of a factor (e.g. urgency) in explaining the use of one mode as opposed to another, and secondly, to determine by how much the occurrence or non-occurrence of that factor increases or decreases the chance of a consignment going by one mode as opposed to another. Thus the analysis does not seek to rank the importance of factors in general transport demand; it aims, in contrast to previous studies, to illustrate how these factors influence the choice of a particular mode as opposed to another.

The probability technique employed is one that allows for the simultaneous inter-action of a large variety of factors, and involves the analysis of consignments sent by two specified modes. Thus, if one considers transport on own account and professional road haulage an analysis of the consignments sent by these two modes is made in an attempt to see what factors influence the use of the one mode as opposed to the other. This particular technique makes it possible to calculate the degree to which any single factor explains the use of one mode as opposed to another, and also by how much it increases or decreases the probability of consignment going by one of the two modes, other factors considered(2).

It is to be noted that the determinants of the distribution of traffic between modes are considered for the total transport market in manufacturing industry, and the reader is again reminded that these results do not necessarily hold for specific transport markets. They are presented to illustrate the kind of results that one can expect from this type of analysis, and it is hoped that such analysis will eventually be applied to micro markets where the results will not suffer from the problems of heterogeneity and cancelling out of factors encountered in an aggregate situation.

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[1] Details of the technique of analysis are contained in the Appendix together with the results and commentaries.

[2] One is tempted to conclude that as the influence of the other factors is taken into account when assessing the importance of a particular factor that the ceteris paribus conditions of partial equilibrium analysis have been observed. But this is to overstate the case, for as has already been argued there is a tendency for certain classes of traffic to be sent by specific modes and, therefore, when considering the influence of a particular factor all other conditions cannot be made the same. Thus if all 50 ton consignments of coal for hauls of 100 miles are sent by rail, one cannot compare the journey times of road and rail for the carriage of 50 ton consignments 100 miles ceteris paribus because road shipments of this nature would not include coal. The clearest case of this specialisation is seen with respect to length of haul where 80 per cent of transport on own account consignments are carried less than 50 miles compared with only 14 per cent of rail consignments. In the analysis, therefore, the expression 'other factors considered' has been used rather than ceteris paribus.

The factors considered in the analysis under the three broad groupings are:—

Factors relating to consignment
Length of haul; regularity of shipment; consignment weight; use of container; use of special vehicle or wagon; inter-establishment movement; consignment required more urgently than usual; performance of ancillary service; type of commodity; destination; journey time.

Factors relating to firm
Location; number employed; ownership of 'C' licence fleet; 'A' contract or 'C' hire arrangements; ownership of rail siding.

Subjective assessments with respect to:
Ready availability of a mode; speed of delivery to meet customers requirements; speed of delivery to ensure quick turnround of vehicles; speed of delivery to keep stock levels low; good record with respect to damage; good record with respect to loss; charges by alternative modes.

In the following paragraphs a summary of the results has been given for each pair of modes but detailed results and technical commentaries are contained in the Appendix. Throughout this section references have been given to the relevant tables and commentaries in Part II so as to facilitate interpretation of the results.

Transport on own account/Professional transport(1)

Length of haul was by far the most important determinant of whether a consignment went by transport on own account, 'explaining'(2) 24 per cent

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[1] This following analysis attempts to rank the factors that influence the distribution of traffic (in terms of consignments) between transport on own account vehicles and professional operators. Except where specifically mentioned the analysis is based upon consignments in the General Survey which went by either of these modes. As professional operator includes all types of professional operation (road haulage, rail, G.P.O., waterways, coastal shipping, domestic air transport) this entailed all consignments in the General Survey. The analysis of prices and the prices of alternative modes is, however, only based upon the 400 consignments for which this information was available.

[2] In this context statistical explanation measures the extent to which a specified factor accounts for the observed distribution of traffic between modes. It may be illustrated imperfectly but intuitively as follows: If in every instance where a consignment went by rail the shipper owned a siding, such ownership may be said to explain 100 per cent of the decision to send a consignment by rail. If, however, this is only true in 50 per cent of the cases of consignments going by rail, then we must seek other factors to explain the remaining 50 per cent. Type of commodity might, for instance, account for 10 percentage points of the remaining 50 per cent of consignments going by rail, and so additional factors can be added to try and account for the reason why the remaining consignments are sent by rail. It will be appreciated, however, that there may be a large variety of other factors, which influence the decision to send a consignment by a particular mode, and that it is not feasible to identify and quantify all these additional factors individually. It would, therefore, be extremely rare to account for the reasons that determine choice in every instance and thus 100 per cent explanation is seldom achieved.

of the distribution of traffic (in terms of consignments) between these two modes, and having an explanatory power five times as great as the next most significant factor consignment weight (see pp. 29—30 of Part II for an illustration of this point in tabular form). As might have been expected the greater the length of haul the greater is the probability of a consignment going by professional operator. However, every 25-mile increase in the length of haul does not increase the probability of carriage by a professional operator by the same amount. Thus if one considers a haul of 25 miles and one of 50 miles there is a very much greater chance of the consignment going by professional operator in the latter case than in the former; and if one considers hauls of 50 miles and 75 miles there is also a greater chance of carriage by a professional operator in the latter case than in the former, but the difference is nowhere near as great as in the previous example. This is illustrated in the table below, where it can be seen that a reduction in the length of haul from 50 miles to 25 miles increases the probability of carriage in the firms' own vehicles by 11 per cent (or conversely reduces the probability of carriage by a professional operator by 11 per cent), whereas an increase in the length from 50 miles to 75 miles increases the probability of carriage by a professional operator by only 6 per cent(1).

Length of haul	*Increased probability of carriage by professional operator*
25 miles	47 percentage points
50 miles	58 percentage points
75 miles	64 percentage points

As far as the administrator or transport provider is concerned the knowledge that increasing length of haul increases the probability of carriage by professional operator may be sufficient. It is, however, interesting to consider possible explanations for this effect of the length of haul which may arise from the structure and the organisation of the industry.

For short multi-drop hauls problems of load amalgamation and return loads do not occur, but for longer hauls these become increasingly important and the 'C' licence operator may well find that due to an only partially full vehicle on the outward journey and an empty one on the return journey that his cost per ton-mile is frequently considerably in excess of that of the professional operator who is able to attain much higher vehicle utilisation on such hauls.

The longer hauls besides involving high prices for transport on own account operators may also increase the problems of administration. Except for the

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[1] Increased probability refers to the fact that this is the increase in probability that results from adding this probability onto the probability that had already been obtained as a result of taking the other factors into account that influence the distribution of traffic. This additative nature of the probabilities is illustrated in the Appendix p. 24.

very large fleets there is little chance of the driver being able to change vehicles en route and return home for the evening, and this brings with it social costs of inconvenience to the driver as well as the private costs to the firm of an overnight stay. Also where small fleets are concerned a vehicle away from base for a number of days may cause great inconvenience to the firm in the form of lost flexibility.

Consignment weight was the second, but much less important factor determining the distribution of traffic between these modes. It may seem surprising however, that the larger the consignment the greater the chance that it will be carried on own account. This result is, however, influenced very largely by the frequent use of the G.P.O. parcels service for very small consignments (this accounts for 65 per cent of consignments up to 22 lbs —see Table 3, p. 31) and of the rail passenger and freight train smalls services for consignments of up to ¼ ton (see Tables 3 and 4, pp. 31—32).

The factors other than length of haul and consignment weight added individually little to the explanation of the distribution of traffic, but some of the results are of great interest and these are considered in the following paragraphs. It is, however, important to emphasise again that this analysis is not attempting to rank factors which are of general importance to shippers, such as reliability and speed, but those factors which are important in influencing the distribution of traffic between modes.

In the case of length of haul it was argued that *price* (*or cost of transport on own account*) was probably the pertinent influence that underlay the importance of this particular factor in determining the distribution of traffic between own account vehicles and professional operators. The analysis of consignments where the charge by an alternative mode was known showed, however, that price, other factors considered, had a low influence upon the distribution of traffic, i.e. demand was found to be very price inelastic. Where, for example, own account transport was 25 per cent more expensive in terms of price or cost than the cheapest usable(1) alternative this only increased the probability of a consignment going by a professional operator by 6 per cent(2). Such a finding means that shippers generally put other characteristics of service before price and this is illustrated in Part II pp. 39—42 where it can be seen that a large proportion of shippers knowingly use a mode that is more expensive than a useable alternative. This result is supported by a study of parcels traffic carried out by British Rail in Leicester, where it was found that 'only 2 per cent of firms would be persuaded to accept slower service, even by

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[1] Shippers were asked to give charges by alternative modes which they could have used.

[2] It will be remembered that where consignments went by transport on own account it was necessary to apportion costs of carriage to them and that the method of cost allocation was open to error. But one-half of the consignments in this analysis went by professional operator and it is, therefore, the shipper's own assessment of the cost of his own vehicles that is used, and in any case the elasticity is so low that even a substantial degree of error would not alter the conclusion.

quite considerable discounts'. The reason for the seeming contradiction of this finding on price and that on length of haul lies in the two-thirds of consignments for which the shipper did not know the charge by an alternative mode; these consignments being taken into account in the analysis of length of haul but not in the analysis of price.

There may be various logical explanations for a shipper not knowing the charge of sending a consignment by an alternative mode, two of which are important in this context: firstly, no other mode may be suitable in which case demand would be perfectly inelastic with respect to price; secondly, the shipper may be using a mode which he knows is very much cheaper than any alternative and he has as a result not established the exact cost of an alternative, e.g. a shipper sending train load traffic on long hauls would not consider determining the exact cost of sending this by road as he knows it will be appreciably more expensive. In most cases where shippers on own account did not know the charge by alternative modes there were reasons to suppose that no alternative was suitable: 52 per cent of these cases involved, for instance, local deliveries, and 39 per cent of consignments that were required more urgently than usual(¹) (see Table 11 Part II). Where, however, the shipper had used a professional operator and did not know the charge by an alternative mode there were comparatively few cases where another mode was not feasible. And in these cases it could well be argued that the shipper knew it was much cheaper by professional operator and had not bothered, therefore, to establish the exact cost of carriage in his own vehicles(²). This could, for instance, well be the case for many hauls over 50 miles—such hauls accounting for 86 per cent of rail consignments, 77 per cent of road haulage consignments, 73 per cent of G.P.O. consignments, but only 20 per cent of transport on own account consignments.

It can be concluded, therefore, that where an alternative mode is suitable that price will be outweighed by other features of service provided that the price differential is not vast. Where, however, one mode is very much cheaper than another the cheaper one is preferred. It will be seen below, however, that there do not appear to be vast quality of service differentials in the minds of shippers between professional operators and transport on own account, so that this last statement may be qualified to the extent that price is important where there are substantial price differentials but not substantial differences in the quality of service. This brings to light, of course, the very important constraint on this type of analysis, in that actual situations are being compared. It is not possible to say what would be the effect of a large difference in price if there were a large difference in the quality of service.

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[1] As consignments had sometimes more than one special feature the percentages do not add to 100.

[2] It might, of course, be reasoned that these shippers should have known the charge by other professional operators, but this in no way invalidates the argument as only cases were the shipper had given the cost of using his own fleet were used in the previous analysis of price elasticities.

It should again be stressed that these conclusions relate to the total transport market. It has already been noted, for instance, that there will be specific markets in which only one mode operates and where in the short run demand would be perfectly price inelastic. Similarly in other specific markets where several modes operate demand can be highly price elastic.

Ownership of a 'C' licence fleet has frequently been considered to substantially reduce the use made of professional operators, but such ownership only increased the probability of carriage in the firms' own vehicles by 16 per cent. Here it is worth stressing once more the importance of allowing for the simultaneous inter-action of all factors determining choice. Overall 48 per cent of all consignments are carried on own account (see Table 7) but this is influenced by a great many factors other than actual ownership of vehicles, the most important being the length of haul. The fact of actual ownership of vehicles only increases the chance of carriage in those vehicles by a comparatively small amount. The ownership of rail sidings and the availability of vehicles under 'A' contract were likewise not very strong determinants of modal choice and only increased the probability of carriage by a professional operator by 22 per cent and 10 per cent respectively. After acquiring specific transport facilities, therefore, industrialists will not use them exclusively but will continue to make frequent use of other modes.

The use of special bodies and containers was interesting for the former increased the probability of carriage in the firms' own vehicles by 14 per cent, whereas the latter reduced the probability by 11 per cent. The provision of special vehicle facilities, therefore, only marginally increases the chance of carriage on own account indicating that such facilities are frequently provided by professional operators, and containerised traffic is in fact more predominant in professional than own account operations.

The subjective assessment factors added practically nothing to the explanation of the decision to use transport on own account or not, and the factor freedom from damage was, in fact, insignificant. What is particularly interesting, however, is the fact that where the shipper considered ready availability, speed to meet customers' requirements, and freedom from loss important this increased the likelihood of carriage by a professional operator. This somewhat surprising result stems from the fact that 18 per cent of the shippers for whom transport on own account was their main mode did not consider any of the subjective questions to be important in determining their choice of mode, compared with only 9 per cent of the shippers for whom a professional operator served as their main mode. It may be that transport on own account operators are so used, for example, to freedom from loss and damage that they do not think of them as important, but, in whatever way one seeks to explain this one cannot escape from the fact that although industrialists consider factors such as ready availability and speed to be very important in their general transport requirements (see footnote 1 p. 15), they are not of such great importance in influencing the use of either a professional operator or transport on own account.

It should, however, be noted that as shippers tend to use a number of modes the qualities looked for by a shipper as indicated by his subjective assessments do not necessarily apply to all the modes he uses but only to the main ones. The relating of these assessments to individual consignments and the modes used for them in the analysis means, therefore, that in some instances qualities will be attached to particular modes when this was, in fact, not intended by the shipper. This will lead consequently to a reducing of the significance of these assessments in the analysis and to the exclusion of marginally significant ones. But this effect should not be too great and there could, in any case, be no question of changing the direction of their influence upon modal choice. It will be seen later, however, that these results appear to be highly sensitive to the type of commodity being carried.

In some instances the *type of commodity* carried served to increase the probability of carriage on own account by a substantial amount. The carriage of manufactured foodstuffs, for instance, increasing the probability by as much as 33 per cent, but this is, of course, to be expected given the shortness of the hauls for this commodity.

Finally, two findings are of great interest precisely because they relate to factors that are insignificant in determining the distribution of traffic between transport on own account and professional operators. The analysis showed that there was no significant difference, other factors considered, in the effective journey times of professional and transport on own account operators, and in knowledge of charges by alternative modes of shippers using either professional operators or transport on own account.

The finding on *journey time* is extremely interesting for it supports the hypothesis put forward earlier on the situations ex-ante and ex-post the decision on choice of mode. Speed was considered important by over 80 per cent of the shippers in determining their choice of mode(1) yet ex-post the decision there was no significant difference, other factors considered, in the performance of transport on own account and professional operators. In other words shippers have only sent that traffic by a particular mode which that mode can transport quickly, and where modes have been considered to have a poor speed record with respect to certain types of traffic they have not been

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	per cent of firms	
	1st choice	2nd choice
Ready availability	44	23
Speed	38	46
Freedom from damage	3	10
Freedom from loss	2	7
None	13	14
	100	100

used. This selecting of a mode is seen, for example, in parcels traffic where the extremely efficient and speedy G.P.O./rail services carry the bulk of this traffic and for journeys other than local deliveries the large bulk of it (see Part II, pp. 32—33).

The evidence on *knowledge of charges by alternative modes* showed that shippers using their own transport are just as likely to know the price of using an alternative mode as are shippers using professional operators (see Part II, p. 39).

In summary, therefore, length of haul is overpoweringly the most important determinant of whether a consignment is shipped in the manufacturer's own vehicle or not, with consignment weight the second, but far less important, factor. All the other factors considered added individually very little to the explanation of distribution of traffic.

It would, of course, be interesting to know what changes there are in these determinants when a definite alternative to transport on own account is specified, and this is done in the following sections.

Road Haulier/Transport on Own Account(1)

When public road haulier is the alternative to transport on own account there are few fundamental differences from the above analysis. *Length of haul* is again by far the most important factor, explaining 21 per cent of the distribution of traffic between own vehicles and road hauliers and having an explanatory power seven times as great as the next most important —freedom from loss; the probability coefficient being almost identical to that in the previous model.

When *freedom from loss* is specified as important in determining choice of mode it ranks second in explanatory power, it is, however, rarely specified. Only 2 per cent and 7 per cent of the firms ranked it first and second respectively in their subjective assessments. It was, as mentioned previously, ranked more frequently by shippers using road hauliers as main mode (3 per cent and 12 per cent for first and second rankings respectively) than shippers using their own fleets as main mode (2 per cent for both first and second rankings). But the fact that it is considered as relatively unimportant by shippers indicates that the level of loss must be very low and differ little between modes, and this is borne out by the information collected on consignments (see Part II, pp. 43—45).

Consignment weight was, in contrast to the previous analysis, insignificant in determining the distribution of traffic between these two modes. This means, as was previously explained, that the smaller consignments are carried

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[1] This analysis is based upon all those consignments shipped either by a professional road haulier or on own account.

by G.P.O. and rail and that there is no significant difference, other factors considered, between the size of consignments carried by road in the firm's own vehicles and professional hauliers' vehicles.

The remaining factors had individually little explanatory power and had the more or less identical influence to that experienced when no definite professional operator was specified. It is, however, interesting to note that ownership of 'C' licence vehicles was fairly close in explanatory power, to the factor freedom from loss and had an explanatory power three times greater than was the case when no definite alternative to transport on own account was specified. This is, of course, to be expected, for once the decision has been made to send a consignment by road, as in this instance, the ownership of vehicles plays a more important role than when all alternatives are being considered.

The type of commodity being carried has been taken into account in the previous analysis by the inclusion of thirteen commodity groupings as explanatory variables. It was, however, pointed out in the Survey Method that the importance of commodity in modal split could well be reduced amongst these rather heterogeneous groupings. In order to obtain some information on this two models were run on the data collected in the Commodity Survey. This analysis was concerned with determining the significant factors influencing the distribution of traffic between transport on own account and public road hauliers for the carriage of heavy chemicals (M.L.H. 271) and paper (M.L.H. 481-3), and it differed from the above general model only to the extent that only hauls above and below 25 miles were differentiated i.e. the definition of a local delivery in the consignment note. The reason for the change was to attempt to establish a distance cut-off point between the modes.

In the case of Paper length of haul had exactly the same explanatory power (21 per cent) as in the general model, with consignments being carried for less than 25 miles increasing the probability of carriage in the firm's own vehicle by 38 per cent. This was, as previously, by far the most important factor explaining the distribution of traffic between the two modes and having an explanatory power five times as great as the two next most important variables—ownership of 'C' licence vehicles and the availability of vehicles under 'A' contract. The importance of ownership or availability of a mode of transport is, as was previously argued, to be expected when choice is between two forms of road transport, and it is, if anything, a little surprising that it did not appear as more significant in the general model.

The remaining factors were of minor importance and had similar influence to those in the general model but it is worth noting that consignment weight was just significant in influencing the distribution of traffic, with increasing size increasing the probability of carriage in the firms' own vehicles, and that the subjective assessments gave different results from previously. For the first time freedom from damage appeared as significant and increased the likelihood of carriage in the firms' own vehicles, as did the only other significant subjective assessment—ready availability. The latter had, however, the opposite effect from that experienced in the general model.

The analysis of consignments of Chemicals had some interesting differences. Ownership of 'C' licence vehicles was in this case by far the most important factor explaining the distribution of traffic—such ownership increasing the probability of carriage in own vehicles by 33 per cent. The influence of local delivery was still very great but its reduction in explanatory power indicated that 25 miles was too low a cut-off point to differentiate between the two modes. A re-run of the model with length of haul as a continuous variable showed, however, similar results, suggesting that 25 miles is indeed the pertinent cut-off point. What was particularly interesting about this model, however, was the fact that three of the significant factors had the opposite effect from the case of Paper. Again freedom from damage and ready availability were the only subjective assessments that were significant in determining modal split but in this instance they increased the probability of carriage by public road haulier—the probabilities 21 per cent and 11 per cent being almost identical to the case of Paper but having exactly the opposite effect. Weight also had the opposite influence, increasing weight, in this instance, reducing the probability of carriage in own vehicles.

The tendency, therefore, of certain variables to change their sign according to the nature of the commodity could well result in the significance of these variables being lost in a global model due to their opposite effects with respect to individual commodities being cancelled out. However, this was only the case for variables of very low explanatory power even in a specialist market so this would not affect the main conclusions of the general model.

Rail(¹)/Transport on Own Account

Length of haul was, as in previous instances, by far the most significant factor, explaining 32 per cent of the decision to use one of the two modes. As before the greater the length of haul the less the probability of a consignment going on own account with the probability coefficient being very similar to that when public road haulage was specified as the alternative to transport on own account.

Consignment weight was the second most important factor explaining 9 per cent of the decision to use rail or transport on own account. As has been noticed on previous occasions the greater the weight of consignment the greater the chance of carriage on own account.

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[1] Rail does, of course, include many types of services and these are not differentiated (see, however, Part II, pp. 52—55 for a discussion of these). It should also be noted that at the time of the Survey the railways' new freightliner services were in their infancy and these may have resulted in important changes since the time of the Survey (see Part II, pp. 59—60 for a discussion of their possible influence).

The remaining variables were of low explanatory power and behaved in exactly the same manner as has been noted previously.

Rail/Road Haulier(1)

Analysis of the distribution of traffic between these two modes of professional operator was of particular interest in that it allowed an assessment of the importance of price to be made without the problem of cost allocation that had occurred in the case of transport on own account. There was also not the same possibility that the importance of price was concealed in length of haul as both these carriers operate over long distances (see Part II pp. 29—30). On the sample available the analysis suggested but did not show conclusively that where the charge by an alternative mode was known, the relationship between the actual charge and the charge by a usable alternative was not a factor that helped in determining the distribution of traffic between the two modes considered(2).

Unlike in the previous analyses of transport on own account there was no factor, such as length of haul, which was more important than all the other factors in the model put together. This analysis of rail and road haulier showed, in fact, that *consignment weight* was the most significant factor, but explaining only 7 per cent of the distribution of traffic between these two modes, with the small consignments increasing the probability of carriage by rail. The reduction of *length of haul* in explanatory power (4 per cent) to equal second place with freedom from loss (when specified) results from the fact that both these forms of public operator carry over significantly greater distances than is the case with transport on own account, and that, therefore, journey length is not so important in determining modal split. However, length of haul did have the influence that one would have anticipated with increasing length of haul increasing the probability, other factors considered, of carriage by rail. The effect of increasing length of haul is, nevertheless, much less than was the case with transport on own account with a journey of 75 miles only increasing the probability of carriage by rail by 20 per cent other factors considered.

Ready availability and speed to meet customers' requirements were deemed important by a large number of firms (see note p. 15) and both these factors increased the probability of carriage by road haulier. What is interesting about this, however, is the fact that although the shipper might have an overall requirement of speed which reduced the likelihood of carriage by rail, when it is necessary to send a consignment more urgently than usual this is not a significant factor influencing the distribution of traffic between the two modes. This

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[1] This analysis is based on all those consignments in the General Survey which went by rail or road haulier with the exception of the analysis of price which is based upon only 200 consignments.

[2] Forcing the ratio charge by rail/charge by road haulier into the equation at a low level of significance (>10 per cent) the analysis showed that where the charge by rail was 25 per cent greater than by road haulier this increased the probability of carriage by road haulier by 4 per cent, a figure very similar to that in the analysis of transport on own account.

results, of course, from the provision by rail of frequent and regular high speed passenger and freight train services.

In some instances *type of commodity* played a significant role in the distribution of traffic with the carriage of Raw Foodstuffs and Iron and Steel increasing the probability of carriage by rail, other factors considered, and the carriage of Iron Scrap, Chemicals and Electrical Goods increasing the probability of carriage by road haulier.

Future analysis

These aggregate results show that if specific markets were differentiated only by length of haul this would go a very long way towards defining markets in which there were only professional operators or transport on own account operators. On the other hand there appear to be no factors that readily isolate professional operators into specialist markets as between themselves. Very important work remains to be done, therefore, on the determinants of the distribution of traffic between professional operators within specific markets, these markets being defined with reference to length of haul, consignment size, type of commodity and perhaps origin of consignment. Only when specific markets are analysed will the importance of quality of service be accurately assessed.

Technical Appendix

It was considered that the most convenient way of handling such large numbers of observations and variables was by the use of multiple regression in a discriminant manner. The regressand is treated as a dummy variable taking on the value of 1 if an event occurs and a value of 0 if it does not, and this is treated as a function of the selected regressor variables. Where one is attempting to discriminate between the use of transport on own account and professional operators the function would be:—

$$Y=f(X_1, X_2, \ldots\ldots X_n)$$

where: $Y = \begin{array}{l} 1 \text{ consignment went by transport on own account} \\ O \text{ consignment did not go by transport on own account.} \end{array}$

X_1 etc=explanatory variables

The calculated value of Y is then interpreted as the conditional probability that the consignment will go by transport on own account given the X's(¹).

A number of authors commenting on this type of probability model have either suggested or employed a constraint on the co-efficients so that they cannot sum to more than 1. The theoretical case for such an approach is,

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[1] One of the problems of using a dichotomous regressand is that the error term is hetroscedastic. Professor Goldberger has suggested a two stage method for correcting for this (see Econometric Theory p.249), but the bias was considered so small as not to warrant such an expensive procedure. Other authors using this method have also taken this view and have made no correction in their work.

however, doubtful. In an unconstrained model a number of combinations of variables might result in certainty, in a constrained model only a combination of all variables would lead to certainty. The constraint, therefore, takes away from the importance of all the variables and reaches the very unrealistic assumption that only a combination of all variables can lead to certainty. In the models below no constraint has been applied; and in cases, for example, where a combination of 3 out of 4 relevant variables have co-efficients that sum to 1 the addition of the fourth (positive) variable is to be interpreted as to having no effect on a situation where certainty already attains.

The variables that were used in the analysis are listed below:—

Factors relating to consignment

(1) Length of haul (miles)
(2) Journey time (days)
(3) Charge (pence)
(4) Consignment weight (lbs)
(5) Regularity of shipment
(6) Container used
(7) Special body required
(8) Inter-establishment move
(9) Consignment required more urgently than usual
(10) Ancillary service performed
(11) Type of commodity
(12) Destination

Factors relating to firm

(13) Origin
(14) Size of firm
(15) Ownership of rail siding
(16) Ownership of 'C' licence vehicles (or use of pool)
(17) Vehicles under 'A' contract

Subjective assessments

(18) Knowledge of charge by alternative mode
(19) Charge by alternative mode
(20) Speed required to meet customers' requirements
(21) Speed required to ensure high utilisation of vehicles
(22) Speed required to maintain low stock levels
(23) Ready availability of vehicles
(24) Freedom from loss
(25) Freedom from damage

The continuous variables—length of haul, journey time, weight and charge (1 – 4) – were entered as logarithmetic values as it was considered that the probability function with respect to these variables was non-linear. The other variables were entered as dummies and are defined below:—

Regularity

Only regular and irregular traffic were differentiated; shipments taking place at intervals of less than one month being regarded as regular and greater than one month as irregular.

Variables 6 – 10

These variables are self explanatory and relate to whether these particular factors pertained to a consignment or not; in the case of an ancillary service only the existence of such a service was taken into account, the different types of service were not differentiated.

Type of commodity

Thirteen commodity groups were differentiated: raw foodstuffs; manufactured foodstuffs; coal and oil; iron scrap; iron and steel; chemicals; building materials; transport vehicles and equipment; electrical goods; non-ferrous metals; metal manufactures; other manufactures; miscellaneous.

Origin and Destination

These were confined to the ten Planning Regions. Due to the large number of variables already in the model combinations of origins and destinations could not be used. This meant that in some instances the influence of this variable on the distribution of traffic between modes would be lost, e.g. if a particular mode specialises in traffic on high density routes and another on low density routes this influence will be lost where the origin is an industrial region and the destination a development region or vice versa.

Size of firm

These size groups were differentiated on the basis of numbers employed—(1) 11—99 employees (2) 100—499 employees (3) 500 and over employees.

Variables 15 – 17

These denote solely whether or not the firm has these facilities at its disposal.

Knowledge of charge by alternative mode

This denoted only whether the shipper knew the charge of sending the consignment by an alternative mode.

Charge by alternative mode

This is what the shippers thought would be the charge of sending the consignment by a suitable alternative mode. Its treatment in the model is discussed later.

Variables 20–25

These denote whether or not the shipper considered these factors important in determining his choice of mode. First and second choices were not differentiated.

The inclusion of so many regressor variables could tend to unreliability in the estimators even with so many degrees of freedom; on a priori grounds it was difficult to reject any, but the use of a 5 per cent level of significance ensured that a large number of variables would not enter into the final calculations of the estimators in the step-wise regression.

Details of the various models are given in the following paragraphs.

Transport on own account/Professional transport

The first run of the general survey data included all the variables except variable 20 (charge by alternative mode). It showed that Journey Time and Knowledge of Charges by Alternative Modes were not significant in discriminating between these two modes, and that a high degree of multi-collinearity existed between Charges and Consignment Weight (zero-order correlation co-efficient: 0.85). It was decided, therefore, to do two re-runs of the data: firstly, to re-run the model excluding journey time, knowledge of charges by alternative modes and charge—this meant that the model would be based upon a far larger number of observations(¹), a factor which is very important to ensure accuracy when estimators are based upon the means of cells as in this case. Secondly, to attempt to obtain further information on the influence of price. The significant co-efficients and their standard errors for the first of these two runs are given below:—

$$Y = \begin{matrix} 1 \text{ Transport on own account} \\ 0 \text{ Transport not on own account} \end{matrix}$$

Constant	0.53		
(1) Haul	−0.34	(0.008)	
(4) Weight	0.08	(0.004)	
(5) Regularity	0.12	(0.009)	
(6) Container	−0.11	(0.011)	
(7) Special body	0.14	(0.028)	
(9) Urgency	0.08	(0.010)	
(11) Foodstuffs (manufactured)	0.33	(0.018)	
(11) Iron scrap	−0.08	(0.021)	R=0.64
(11) Transport vehicles and equipment	0.12	(0.016)	
(11) Non-ferrous metals	0.16	(0.028)	
(12) Destination (East Midland)	0.14	(0.014)	
(12) Destination (South East)	0.05	(0.010)	
(12) Destination (Scotland)	0.04	(0.015)	
(13) Origin (Northern)	0.19	(0.032)	
(13) Origin (Yorkshire)	−0.06	(0.012)	
(13) Origin (South Eastern)	0.08	(0.012)	
(13) Origin (North Western)	0.05	(0.013)	

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[1] Information on these factors was only obtained for about 25 per cent of the total number of consignments (see footnotes pp. 3 and 7).

(14) Size (2)	0.06	(0.010)
(14) Size (3)	0.03	(0.013)
(15) Siding	−0.22	(0.026)
(16) Own vehicles	0.16	(0.016)
(17) 'A' contract vehicles	−0.10	(0.012)
(21) Turn-round speed	−0.27	(0.023)
(22) Speed to maintain low-stocks	−0.20	(0.020)
(23) Ready availability	−0.06	(0.013)
(24) Freedom from loss	−0.16	(0.015)

Overall nearly one-half of the consignments in the General Survey went by transport on own account, but if, for instance, we assumed that a consignment of iron-scrap weighing 12 tons were shipped 75 miles from a medium sized firm with its own vehicle fleet and where none of the other significant variables was pertinent, the probability of it going on own account would be:—

$$\underset{\text{(constant)}}{P=0.53} - \underset{\text{(iron-scrap)}}{0.08} + \underset{\text{(weight)}}{0.09} - \underset{\text{(haul)}}{0.64} + \underset{\text{(medium firm)}}{0.06} + \underset{\text{(own fleet)}}{0.16} = 0.12$$

The probability of it going by professional transport is, of course, 0.88 i.e. the co-efficients take the opposite signs and the intercept becomes 0.47.

In order to obtain information on the elasticity of substitution it was decided to introduce the ratio cost by transport on own account/charge by professional operator into the model. One of the difficulties of doing this was the low number of observations on charges by alternative modes, and even where shippers using professional operators had given alternative charges they had often not given transport on own account as an alternative. As length of haul and consignments weight were overpoweringly the most important variables in the previous analysis it was decided to run the model with only these two variables plus the price ratio in order to keep the number of observations as high as possible.

This model worked very well with no multi-collinearity; with the error term behaving well (no specification bias); and with the co-efficients similar to that in the previous model. (1)

$$Y = \begin{matrix} 1 \text{ transport on own account} \\ 0 \text{ transport not on own account} \end{matrix}$$

Constant	0.65		
Haul	−0.29	(0.043)	
Weight	0.10	(0.017)	R=0.43
Price ratio	−0.05	(0.015)	

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[1] There is, of course, no need for the co-efficients to be the same, for, as was argued in the text, the consignments where an alternative charge is known are likely to be different in character from those where an alternative charge is not known.

The relevant point elasticity at the point of means is:

$$\frac{dP}{dR} \cdot \frac{R}{P} = 0.21$$

where:

P = conditional probability

R = price ratio

Road haulier/Transport on own account

This model was identical in form to the previous general model except that variable 15 (Private siding) was omitted, and the significant co-efficients and their standard errors are listed below:—

$$Y = \begin{matrix} 1 \text{ road haulier} \\ 0 \text{ transport on own account} \end{matrix}$$

Constant	0.15		
(1) Haul	0.33	(0.010)	
(5) Regularity	−0.12	(0.011)	
(6) Container	0.11	(0.013)	
(7) Special body	−0.12	(0.030)	
(9) Urgency	−0.10	(0.012)	
(10) Ancillary service	0.05	(0.021)	
(11) Foodstuffs	−0.27	(0.018)	
(11) Transport vehicles and equipment	−0.18	(0.021)	
(11) Non-ferrous metals	−0.21	(0.035)	R=0.62
(12) Destination (East Midlands)	−0.15	(0.018)	
(12) Destination (South Eastern)	−0.04	(0.013)	
(13) Origin (Yorkshire)	0.14	(0.015)	
(13) Origin (East Midlands)	0.07	(0.015)	
(13) Origin (South Eastern)	−0.12	(0.016)	
(14) Size (1)	0.06	(0.012)	
(16) Own vehicles	−0.22	(0.021)	
(17) ‘A’ contract vehicles	0.14	(0.014)	
(21) Turn-round speed	0.22	(0.025)	
(22) Speed to maintain low stocks	0.26	(0.029)	
(23) Ready availability	0.06	(0.016)	
(24) Freedom from loss	0.27	(0.020)	

Road haulier/Transport on own account (Paper)

This model was similar in form to the previous one except that it was confined to consignments of Paper in the Commodity Survey; the variable length of haul was also replaced by a dummy variable (local delivery) denoting hauls above and below 25 miles in order to try and arrive at a mileage cut-off point.

$$Y = \begin{matrix} 1 \text{ road haulier} \\ 0 \text{ transport on own account} \end{matrix}$$

Constant	1.37		
Local delivery	−0.38	(0.018)	
(4) Weight	−0.02	(0.008)	
(10) Ancillary service	−0.51	(0.115)	
(12) Destination (Northern)	0.17	(0.052)	
(12) Destination (Yorkshire)	−0.08	(0.032)	
(12) Destination (South East)	−0.08	(0.017)	
(12) Destination (South West)	0.07	(0.037)	
(13) Origin (East Midland)	−0.25	(0.048)	R=0.64
(13) Origin (East Anglia)	0.30	(0.042)	
(13) Origin (South East)	0.05	(0.019)	
(13) Origin (West Midland)	−0.40	(0.051)	
(13) Origin (Scotland)	0.32	(0.034)	
(14) Size (1)	0.09	(0.019)	
(14) Size (3)	−0.22	(0.024)	
(16) Own vehicles	−0.54	(0.03)	
(17) 'A' contract arrangement	0.16	(0.02)	
(23) Ready availability	−0.07	(0.029)	
(25) Freedom from damage	−0.22	(0.027)	

A constant term of greater than 1 results from a shortage of low value observations in an n dimensional space. It would have been possible to have overcome this by the use, for example, of a logistic function, but this would have indicated that reliance could be placed on the results obtained from the use of extreme values in the model—any modification was, therefore, rejected.

Road haulier/Transport on own account (Chemicals)

The form of this model is similar to that for Paper (above), and is based upon consignments of chemicals in the Commodity Survey. The results under col. 1 relate to the use of *local delivery* as a dummy variable, and those under col. 2 to *length of haul* as a continuous variable.

$$Y = \begin{matrix} 1 \text{ road haulier} \\ 0 \text{ transport on own account} \end{matrix}$$

	1		2	
Constant	0.49		0.049	
(1) Local delivery (haul)	−0.19	(0.017)	0.18	(0.017)
(4) Weight	0.08	(0.009)	0.08	(0.009)
(5) Regularity	−0.19	(0.018)	−0.19	(0.018)
(6) Container	0.07	(0.022)	0.07	(0.023)
(7) Special body	−0.16	(0.026)	−0.15	(0.026)
(8) Inter-establishment moves	0.07	(0.026)	0.10	(0.026)
(9) Urgency	−0.14	(0.020)	−0.13	(0.020)
		R=0.65		R=0.64
(10) Ancillary service	−0.16	(0.050)	−0.21	(0.050)
(12) Destination (Yorkshire)	−0.15	(0.021)	−0.08	(0.025)

	1		2	
(12) Destination (East Midland)	−0.29	(0.034)	−0.24	(0.035)
(12) Destination (West Midland)	−0.12	(0.032)	−0.08	(0.033)
(13) Origin (Northern)	0.25	(0.030)	0.28	(0.038)
(13) Origin (North Western)	0.29	(0.020)	0.33	(0.029)
(16) Own vehicles	−0.33	(0.024)	−0.33	(0.025)
(17) 'A' contract arrangement	0.15	(0.017)	0.14	(0.018)
(23) Ready availability	0.13	(0.041)	0.13	(0.043)
(25) Freedom from damage	0.23	(0.040)	0.28	(0.046)

Rail/Transport on own account

This model was similar to that for Road haulier/Transport on own account with the exception of variable 17 ('A' contract arrangement) being replaced by variable 15 (private rail siding). The significant variables and their standard errors are given below:

$$Y = \genfrac{}{}{0pt}{}{1\ \text{Rail}}{0\ \text{Transport on own account}}$$

Constant	−0.01		
(1) Haul	0.36	(0.009)	
(4) Weight	−0.11	(0.006)	
(5) Regularity	−0.11	(0.011)	
(6) Container	0.11	(0.013)	
(7) Special body	−0.14	(0.029)	
(8) Inter-establishment move	0.04	(0.016)	
(9) Urgency	−0.05	(0.011)	
(10) Ancillary service	−0.13	(0.022)	
(11) Raw foodstuffs	0.41	(0.17)	
(11) Iron and Steel	0.25	(0.024)	
(11) Building minerals and materials	0.13	(0.021)	
(11) Transport vehicles and equipment	0.05	(0.020)	R=0.74
(11) Non-ferrous metals	−0.13	(0.035)	
(11) Metal manufacturers	0.27	(0.022)	
(12) Destination (Northern)	0.08	(0.022)	
(12) Destination (East Midlands)	−0.08	(0.015)	
(12) Destination (East Anglia)	0.07	(0.035)	
(12) Destination (South Eastern)	−0.05	(0.012)	
(12) Destination (South Western)	0.08	(0.029)	
(12) Destination (Wales)	0.07	(0.027)	
(13) Origin (Yorkshire)	0.08	(0.026)	
(13) Origin (East Anglia)	−0.09	(0.026)	
(14) Size (2)	−0.10	(0.010)	
(15) Private siding	0.21	(0.025)	
(16) Own vehicles	−0.16	(0.022)	
(22) Speed to maintain low stocks	0.31	(0.024)	

(23) Ready availability	0.09	(0.015)
(24) Freedom from loss	0.26	(0.023)

Rail/Road haulier

This model was similar to that for Rail/Transport on own account except that variable 16 (Own vehicle) was replaced by variable 17 ('A' contract arrangement).

$$Y = \begin{matrix} 1 \text{ Rail} \\ 0 \text{ Road haulier} \end{matrix}$$

Constant	0.59		
(1) Haul	0.17	(0.015)	
(4) Weight	−0.15	(0.008)	
(5) Regularity	−0.04	(0.013)	
(6) Container	0.09	(0.015)	
(7) Special body	−0.16	(0.045)	
(8) Inter-establishment move	−0.08	(0.030)	
(11) Iron scrap	−0.22	(0.029)	
(11) Iron and steel	0.34	(0.033)	
(11) Chemicals	−0.28	(0.026)	
(11) Electrical goods	−0.19	(0.029)	R=0.52
(12) Destination (Yorkshire)	−0.05	(0.020)	
(12) Destination (South east)	−0.06	(0.014)	
(12) Destination (Wales)	0.10	(0.030)	
(13) Origin (Northern)	0.14	(0.065)	
(13) Origin (Yorkshire)	−0.07	(0.016)	
(13) Origin (East Midland)	−0.21	(0.016)	
(14) Size (2)	−0.06	(0.016)	
(14) Size (3)	0.10	(0.020)	
(15) Private siding	0.34	(0.034)	
(17) 'A' contract arrangement	0.05	(0.019)	
(20) Speed to meet customer requirements	−0.11	(0.019)	
(21) Turn-round speed	−0.15	(0.037)	
(23) Ready availability	−0.04	(0.020)	
(24) Freedom from loss	−0.26	(0.023)	

In order to obtain information on price the ratio charge by rail/charge by road haulier was included in a model based upon the most significant variables of the above model. The price ratio had the anticipated negative sign but was not significant at the 5 per cent level. The model was based upon only 200 observations as information on relative charges was only available for this number, and this was not a random sub-sample as the co-efficients were rather different from those in the above model. This does not mean, however, that the result is not of value, for, as was previously argued (see p. 24), it is reasonable to assume that where the charges for consignments are known for alternative modes these consignments will be different in character from those where charges by alternative modes are not known.

Part II—Chapter 1—The determinants of modal choice: a tabular approach

In Part I, the analysis of the survey data is undertaken in a perhaps unusual fashion and many readers will be unfamiliar with this method of analysis. For this reason and, indeed, since the techniques used in Part I are to some extent experimental, it was decided also to present the data in tabular form. This is done in the present Chapter.

The essence of the probability approach in Part I is that the relative importance of a factor in its influence on manufacturers' distribution of traffic between modes of transport can only be assessed after the influence of all other factors, taken simultaneously, have been considered. Since the factors that influence choice are numerous, consideration of two or three factors at a time, as in a traditional tabular presentation, could therefore give misleading results. Hence the importance of the probability approach. On the other hand, where the influence of a single factor is particularly large it is to be expected that this influence will also be revealed if the relevant data is set out in tabular form.

Thus, for example, the probability analysis showed short hauls to be the overriding influence on choice of 'C' licensed transport and this can also be clearly demonstrated by expressing the number of consignments carried in each distance bracket as a percentage of the total handled by all modes over that distance, and also by calculating the share of short distance, etc., traffic in the total handled by 'C' vehicles. The relevant figures are given in Tables 1 and 2 below:—

Table 1: Share of each mode in total consignments in each distance bracket.

Percentages

Length of haul		Mode of transport					All modes	
Over	Not over	Own road vehicle	Road haulier	Rail	G.P.O.	Other*	Percent	No. of consignments in survey
	25 miles	82	8	1	6	3	100	22,590
25	50 miles	58	16	9	16	1	100	9,920
50	100 miles	29	33	13	24	1	100	8,920
100	200 miles	18	35	23	23	1	100	14,130
200 miles		16	33	26	24	1	100	8,790
All lengths		48	22	12	16	2	100	64,350

Source: General Survey

*Includes customer collection, coastal shipping, inland waterway, domestic air transport.

Table 2: Shares of short distance, etc. transport in total consignments by each mode.

Percentages

Length of haul		Mode of transport					All modes	
Over	Not over	Own road vehicle	Road haulier	Rail	G.P.O.	Other*	Percent	No. of consignments in survey
	25 miles	61	12	2	12	59	35	22,590
25	50 miles	19	11	12	15	12	15	9,920
50	100 miles	8	21	15	21	9	14	8,920
100	200 miles	8	35	42	31	11	23	14,130
200 miles		4	21	29	21	9	13	8,790
Total		100	100	100	100	100	100	64,350

Source: General Survey

*Includes customer collection, coastal shipping, inland waterway, domestic air transport.

As Table 1 shows, in very short distance transport of up to 25 miles the proportion of consignments carried in 'C' licence vehicles is over 80 per cent and the proportion is also high (nearly 60 per cent) on hauls of between 25 and 50 miles. In medium distance transport of 50 to 100 miles the percentage moved by 'C' vehicles is less than 30 per cent however, while on long hauls of over 100 miles it drops to below 20 per cent. Moreover, the contrast between own account transport and the professional operators in this respect is very marked whichever form of professional operator is considered, but particularly so in the case of the railways. This point is perhaps more clearly brought out by Table 2 which shows that short haul work of less than 25 miles accounts for over 60 per cent of 'C' licence transport (measured in numbers of consignments) compared with 2 per cent of the railways' traffic and 12 per cent of the road haulier's and the G.P.O. while long hauls of over 100 miles account for 12 per cent of consignments by 'C' vehicles, over 70 per cent of the rail borne movements and over 50 per cent of those handled by hauliers and the G.P.O.

A similar tabulation of the data on consignment weight, which was shown by the probability analysis to be the second (albeit a very poor second) most important influence on choice of 'C' transport, displays little concentration in 'C' transport on a particular size of consignment except marginally for consignments of between ¼ ton and 5 tons where the proportion handled by 'C' vehicles rises to over 60 per cent compared with less than 50 per cent in most of the other weight groups (see Table 3). On the other hand, the tabulated data on consignment weight clearly reveals the influence of this factor on the choice between the professional operators. The preference for G.P.O. parcels service for very light consignments of not over 22 lbs is very apparent and although the road haulier is used rather more than the railways for the carriage of consignments of up to ¼ ton, the difference in their shares of the total of such consignments is not very marked. For larger consignments however the haulier is used much more frequently than the railways and carries 26 per cent of all consignments of between ¼ and 5 tons compared with the railways share of 5 per cent, and about 40 per cent of the consignments over 5 tons compared with 11 per cent handled by the railways.

Table 3: Share of each mode in total consignments in each weight group.

Percentages

Weight		Mode of transport					All modes	
Over	Not over	Own road vehicle	Road haulier	Rail	G.P.O.	Other*	Percent	No. of consignments in survey
	22 lbs	17	9	7	65	2	100	18,130
22	112 lbs	35	34	28	1	2	100	14,900
112	560 lbs	44	32	22	—	2	100	10,570
560	1120 lbs	62	27	7	—	4	100	3,530
1120	2240 lbs	74	20	4	—	2	100	4,410
1 ton	5 tons	63	29	5	—	3	100	6,870
5 tons	7½ tons	52	41	4	—	3	100	1,470
7½ tons	10 tons	44	36	15	—	5	100	1,920
10 tons		37	46	12	—	5	100	2,550
All weights		48	22	12	16	2	100	64,350

Source: General Survey

*Includes customer collection, coastal shipping, inland waterway, domestic air transport.

The group limits 22 lbs and 560 lbs were used because the former is the parcels limit by G.P.O. services, the latter approximates to the size limit of passenger train parcels service. Some consignments may be made which are greater than the limit by dividing the consignment into more than one parcel.

This greater use of the haulier for the larger consignments is also shown by the distribution of consignments handled by each mode between the different weight categories (Table 4). Nearly 40 per cent of all consignments handled by road haulage for manufacturing industry weigh over ¼ ton compared with 15 per cent of the railways'. And, taking only the very large consignments of over 5 tons, these account for 15 per cent of the total moved by the haulier compared with 7 per cent of those moved by rail.

Table 4: Consignments in each weight group as a percentage of the total carried by each mode.

Percentages

Weight		Mode of transport					All modes	
Over	Not over	Own road vehicle	Road haulier	Rail	G.P.O.	Other*	Percent	No. of consignments in survey
	22 lbs	12	10	14	99	19	28	18,130
22	112 lbs	21	31	45	1	19	23	14,900
112	560 lbs	18	21	26	—	15	16	10,570
560	1120 lbs	9	6	3	—	9	6	3,530
1120	2240 lbs	13	5	2	—	7	7	4,410
1 ton	5 tons	17	12	3	—	14	11	6,870
5 tons	7½ tons	3	4	1	—	3	2	1,470
7½ tons	10 tons	3	4	3	—	6	3	1,920
10 tons		4	7	3	—	8	4	2,550
Total		100	100	100	100	100	100	64,350

Source: General Survey

*Includes customer collection, coastal shipping, inland waterway, domestic air transport.

Moreover, as the probability analysis showed, length of haul is not a highly significant influence on the choice of road haulage versus rail for a given size of consignment—though the probability of use of rail does increase slightly the greater the haul. This can be displayed in tabular form and Table 5 contains the relevant figures. These show that the haulier's share of total traffic is considerably greater than rail's for all sizes of consignments over ¼ ton and over all distances, but the difference between their respective shares does narrow with increasing length of haul. This is also true of the lighter consignments of not over ¼ ton and on hauls over 100 miles rail carries as many of these light consignments as the haulier, while on hauls of over 200 miles rail's share is larger than the haulier.

Table 5 also displays an interesting feature in the choice between the G.P.O. and other modes for the carriage of small consignments. Whereas the G.P.O.'s share approaches 80 per cent on hauls over 25 miles, because of the preference for 'C' transport for short hauls, its share drops to just over 30 per cent in the carriage of consignments of not over 22 lbs on journeys up to 25 miles. Another factor shown by Table 5 is, where long hauls are involved, the increasing frequency of use of 'C' transport with increasing size of consignment. Own vehicles are used for long hauls of over 100 miles for about 18 per cent of all consignments (see Table 1) but the proportion is 1 per cent for very small consignments, 11 per cent for consignments of 23 lbs to ¼ ton, 37 per cent for consignments weighing between ¼ and 7½ tons and about 23 per cent for consignments over 7½ tons—though the number of the latter consignments is relatively small and sampling errors in the estimates therefore rather large.

Table 5: For four groups of consignment size: Share of each mode in total consignments in each distance bracket

Percentages

Length of haul		Weight of consignment																	
		Not over 22 lbs					23 lbs-¼ ton				¼ ton-7½ tons				Over 7½ tons*				
Over	Not over	Own road vehicle	Road haul-ier	Rail	GPO	Other	Own road vehicle	Road haul-ier	Rail	Other	Own road vehicle	Road haul-ier	Rail	Other	Own road vehicle	Road haul-ier	Rail	Other
	25 miles	56	5	1	33	5	83	11	2	4	84	11	—	5	63	24	4	9
25	50 miles	14	9	4	72	1	35	32	31	2	83	14	1	2	48	41	1	10
50	100 miles	2	9	7	82	—	20	54	24	2	64	29	5	2	51	40	3	6
100	200 miles	1	11	10	77	1	12	44	42	2	42	46	10	2	13	61	24	2
200 miles		1	12	14	72	1	9	41	46	4	29	56	12	3	35	37	26	2
All lengths		17	9	7	65	2	39	33	25	3	65	27	5	3	40	42	13	5
						→ 100				→ 100				→ 100				→ 100

Source: General Survey

'Other' includes customer collection, coastal shipping, inland waterway, domestic air transport and for weight groups over 22 lbs, G.P.O.

*Because of fewer observations, sampling errors in these estimates are larger than in the estimates for the other weight groups.

The proportionally greater use of ‘C’ licence vehicles on the longer hauls when the size of consignment is large is also displayed by Table 6 for four categories of consignment size, and the table clearly demonstrates the importance of long hauls in transport by professional operators whatever the size of the consignment. For example, although the share of movements over 100 miles in ‘C’ licence transport is 3 per cent where very small consignments are involved, 20 per cent for consignments of ¼ to 7½ tons and nearly 30 per cent for larger consignments, the comparable figures for the railways are 71 per cent, 80 per cent and 89 per cent respectively while those for the road haulier are 56 per cent, 63 per cent and 57 per cent.

Table 6: For four groups of consignment size: number of consignments in each distance group as percentage of the total transported by each mode

Percentages

Length of haul		Weight of consignment																
		Not over 22 lbs					23 lbs-½ ton				½ ton- 7½ tons				Over 7½ tons			
Over	Not over	Own road vehicle	Road haul-ier	Rail	GPO	Other	Own road vehicle	Road haul-ier	Rail	Other	Own road vehicle	Road haul-ier	Rail	Other	Own road vehicle	Road haul-ier	Rail	Other
	25 miles	83	13	5	13	73	70	11	2	51	48	15	1	53	32	12	5	35
25	50 miles	11	15	8	16	10	10	11	14	6	18	7	4	8	21	17	2	34
50	100 miles	3	16	16	21	1	8	26	15	11	14	15	15	11	19	14	4	17
100	200 miles	2	32	37	31	9	8	33	41	12	15	40	50	18	9	38	47	8
200 miles		1	24	34	19	7	4	19	28	20	5	23	30	10	19	19	42	6
Total		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: General Survey

'Other' includes customer collection, coastal shipping, inland waterway, domestic air transport and for the weight groups over 22 lbs, G.P.O.

As regards the influence of particular commodities, although the tabulated data suggests this factor to be an important influence on the use of 'C' transport, with a very marked concentration on own transport occurring in the carriage of foodstuffs and building materials (see Table 7) and such traffic accounting for over half of all consignments moved for manufacturing industry by 'C' vehicles (Table 8), the tabulations are in this instance deceptive since, as the probability analysis showed, it is not the commodity as such that is important but the short hauls which are a marked feature of the movements of foodstuffs and building materials.

The influence of commodity was also not very great in the case of the professional operators except, as Table 7 shows, where carriage of chemicals and electrical goods are involved for which a relatively heavy concentration on road haulage and G.P.O. parcels services occurred, and in the carriage of iron and steel where there was some concentration on rail transport.

Table 7: Share of each mode in total consignments in each commodity group

Percentages

Commodity	Mode of transport						All modes	
	Own road vehicle	Customer collection	Road haulier	Rail	GPO	* Other	Per-cent	Number of consignments in survey
Foodstuffs	92	1	4	3	—	—	100	16,410
Crude materials	25	8	36	24	7	—	100	2,050
Chemicals	15	3	42	3	37	—	100	4,060
Building materials	69	10	18	3	—	—	100	3,660
Iron and steel	20	3	28	32	17	—	100	1,720
Non-ferrous metals	48	1	15	7	25	4	100	930
Electrical goods	15	1	36	17	31	—	100	3,020
Transport equipment	41	2	30	12	15	—	100	2,620
Metal manufactures	27	1	24	13	35	—	100	2,970
Other manufactures	33	1	27	18	21	—	100	26,330
Other commodities	38	3	19	5	34	1	100	580
All industries	48	2	22	12	16	—	100	64,350

Source: General Survey.

*Includes coastal shipping, inland waterway, domestic air transport.

Table 8: **Shares of various commodities in total transport by each mode**

Percentages

Commodity	Mode of transport						All modes	
	Own	Customer collection	Haulier	Rail	GPO	* Other	Per-cent	Number of consignments in survey
Foodstuffs	49	12	5	6	—	—	25	16,410
Crude materials	2	13	5	6	1	4	3	2,050
Chemicals	2	11	12	1	15	2	6	4,060
Building materials	8	31	5	1	—	1	6	3,660
Iron and steel	1	4	3	7	3	6	3	1,720
Non ferrous metals	1	1	1	1	2	19	1	930
Electrical goods	2	3	8	7	9	3	5	3,020
Traosport equipment	3	5	6	4	4	3	4	2,620
Metal manufactures	3	3	5	5	10	6	5	2,970
Other manufactures	28	15	49	62	54	53	41	26,330
Other commodities	1	2	1	—	2	3	1	580
Total	100	100	100	100	100	100	100	64,350

Source: General Survey

*Includes coastal shipping, inland waterway, domestic air transport.

The information in Tables 1-8 is based on numbers of consignments. This is one method of measuring the transport generated by industry, but there are other methods, of which the tonnage and ton miles generated are perhaps more widely used. It is not possible from the present survey to give estimates in terms of ton mileages but it is possible to derive some data on the tonnage generated by the establishments covered by the survey and its distribution between the various modes. The information is given in Table 9 which shows the proportion of tonnage in each distance bracket each mode handles. Because of the assumptions that have to be made in deriving estimates of tonnages from numbers of consignments classified by fairly broad weight groups, the figures are rough estimates only but they clearly illustrate the declining share of transport by own vehicles as journey length increases and the increased share of public operators, rail particularly, on the longer hauls.

Table 9: **Shares of each mode in total tonnage in each distance group**

Percentages

Length of haul		Mode of transport					All modes	
Over	Not over	Own road vehicle	Road Haulier	Rail	G.P.O.	Other	Percent	Tonnage in survey
	25 miles	72	18	3	—	7	100	18,900
25	50 miles	57	33	2	—	8	100	12,400
50	100 miles	57	35	3	—	5	100	12,000
100 miles		29	50	19	—	2	100	36,400
All lengths		48	38	10	—	4	100	79,700

Source: General Survey

Chapter 2—Other survey findings

In addition to the information examined in the previous Chapter the survey produced further data which throws light on demand allocation and the background features of transportation.

Charges by alternative modes

Part of the overall survey of the demand for goods transport was concerned with determining the cost of transporting by an alternative mode to the one used. The results of this part of the inquiry show that one-third of the firms in the General Survey and nearly one-half in the Commodity Survey(1) knew the costs by alternative modes for some or all of their consignments. The proportions of actual consignments for which the alternative charges were given were somewhat lower however, being one-quarter in the General Survey and just under one-third in the Commodity Survey.(2)

The incidence with which alternative charges were known for individual consignments differs according to the mode used, and as Table 10 shows, where a consignment is sent by rail there is a significantly greater chance of the shipper knowing the charges by an alternative mode than if it is sent by any other mode.

The table also shows that the proportion of consignments going by own transport for which the cost by alternative modes is known is not very different from the proportions for road haulage and GPO (22 per cent compared with 28 per cent and 23 per cent).

Table 10: Knowledge of charges by alternative modes Number of consignments

1 Mode used	2 Cost of alternative mode known	3 Cost of alternative mode not known	4 Total consignments	5 Col. 2 as % of Col. 4
Own vehicle	207	734	941	22
Customer's vehicle	17	83	100	17
Road haulier	233	597	830	28
Rail	118	156	274	43
GPO	73	251	324	23
Other	1	13	14	7
Total	649	1,834	2,483	26

Source: General Survey

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[1] For definition of 'General' and 'Commodity' surveys see Introduction.

[2] In the General Survey information was obtained for a sub-sample consisting of 2,483 consignments and costs by alternative modes were known for 649; the corresponding figures in the Commodity Survey were 2,989 and 937.

Where the charges by alternative mode were not known it is important to throw light on the reasons for the use of the mode selected. An examination of the special features in the consignment note should give an indication of some of the factors that will make the choice of one mode imperative but except in the case of transport on own account, large proportions of these consignments had no special features, the proportions being nearly one-half in the case of road haulage, and two-thirds for both rail and GPO. This lack of special features probably means that frequently the shipper is not restricted to one mode but only has a general idea of the charge by alternative modes and does not have this information for specific consignments as was requested. Shippers sending train-load traffic, for example, know that rail is the best way of sending this traffic but would not know the exact charge if sent by road.

Even where special features occur this does not mean that all of those mentioned in the consignment note necessitate the use of a particular mode—advertising, for instance, certainly does not limit choice of mode, but if an extra service is carried out or if a consignment is required urgently this could limit the choice of mode. An examination of the features that could necessitate the use of a particular mode (see Table below) shows that in the case of transport on own account a substantial proportion of consignments had features which could well have ruled out the use of any other mode. For road haulage the proportion is rather low and for rail and GPO it is extremely low.

Table 11:
Special features relating to consignments where charge of alternative modes is not known

Percentages

Feature	Mode Used			
	Own vehicle	Road haulier	Rail	GPO
Indivisible load cannot go by rail	2	1	—	—
Special body	4	4	—	—
Inter-estab move	17	7	3	2
Local delivery	52	16	2	13
Perishable	15	1	4	—
Urgent	39	13	20	12
Extra service	12	6	1	—
Other	95	35	16	5
None	6	45	67	71

Source: General Survey

Note: Some consignments had more than one special feature, thus percentages do not total 100.

The results of this inquiry also yielded some interesting information on the extent to which consignments are sent by the cheapest mode. This analysis could only apply to those consignments sent by professional operators since the cost of individual consignments by own account transport was not collected—mainly because most 'C' operators would not be able to supply the information, except perhaps on the basis of an average for all consignments (see Introduction).

The figures show that over one-quarter of the consignments in the General Survey were sent by modes that were more expensive than the cheapest alternative. It has been suggested that many shippers will use expensive modes because of quality of service factors attached to them, and although an examination of the special features pertaining to particular consignments shows that over two-thirds of the consignments not sent by the cheapest mode in the General Survey had no special features in the consignment note, only one-tenth of these consignments had neither a special feature in the consignment note nor a subjective assessment on the importance of quality of service in the general questionnaire.

An examination of the General Survey shows that where the cheapest mode was not used there were approximately as many instances found of the consignment going by rail as by road haulier even though the proportion of consignments in the General Survey sent by road haulier was greater than for rail. Also shippers were prepared to pay substantially more for the quality of service pertaining to a particular mode, with nearly one-third of the consignments not sent by the cheapest form of transport being sent by a mode that was over 25 per cent more expensive than the cheapest.

In the Commodity Survey two-fifths of the consignments sent by a mode that was not the cheapest incurred transport charges that were more than 25 per cent greater than those of the cheapest mode: in Chemicals and Iron and Steel the proportion was similar to the General Survey, i.e. one-third, but in the other three industries about half of these consignments incurred charges 25 per cent greater than those of the cheapest alternative. It appears, therefore, that in industries like Foodstuffs and Electronics a substantial number of shippers are prepared to meet relatively high charges in order to obtain a high quality of service.

Table 12 : Consignments by professional operators not going by cheapest mode analysed by mode and difference in charges

No. of consignments

Mode used	Cheapest alternative	Percentage by which alternative mode is cheaper				
		Less than 5	5—14	15—25	25—49	50—75
Road haulier	Rail	5	17	14	7	2
Rail	Road haulier	7	7	7	10	8
Other	Road haulier	1	5	9	6	2
Road haulier	Other	1	4	—	—	—
Rail	Other	—	2	—	—	—
Air	Other	—	—	—	—	1
All modes		14	35	30	23	13

Source: General Survey

It should be noted that the table applies to all sizes of consignments despatched by professional operators. Different results may be obtained if the analysis is restricted to a particular consignment size group and further work on this is being undertaken.

In summary, therefore, the foregoing analysis shows that for between a quarter and a third of consignments made by manufacturing industry, the cost of carriage by an alternative mode to the one used is known to the shipper. In such cases, however, it was found that a substantial proportion of consignments are not sent by the cheapest mode. Where the cost of the alternative is not known, the relevant consignments were examined to see whether they had any special features attaching to them which made the choice of the mode used imperative. The result of this analysis showed that in the case of consignments by own road vehicles special features were indicated on the majority of them which could well have meant that there was no alternative to the shipper's own vehicles. In those cases where other modes were used a high percentage of the consignments had no special features. This lack of special features attaching to consignments going by professional operators for which the cost of sending by alternative modes is not known, does not necessarily mean, however, that the shipper is acting irrationally when he does not seek knowledge of the cost of the alternative, since (a) he may have a general idea of the charge by alternative modes but does not have this information for specific consignments as was requested, (b) although a consignment may lack special features, differences between modes in quality of service may still make the choice of the mode used imperative.

Average speed of delivery by various modes

In debating the merits of one mode of transport compared with another, the time goods spend in transit is often mentioned as an important aspect of the quality of service the respective modes offer. The railways in particular are usually considered to offer a below average service in this respect and the road haulier is also criticised occasionally for slow delivery. Such sentiments are normally based on isolated cases however, previous to the present survey the authors are not aware of any systematic attempt to measure the performance, in this respect, of one mode compared with another.

In the present enquiry information was collected on the time taken for various consignments to reach their destinations when sent by various modes and the results are presented in Table 13. These results however need careful analysis to allow for differences between modes in average length of haul. After allowing for the very short hauls undertaken by 'C' vehicles there is really little to choose between own transport and the haulier in their average transit times for most consignments, except perhaps a tendency for the haulier to have a slightly larger proportion of consignments still undelivered after the third day—which would tend to pull down his overall average compared with the own account vehicle. To some extent the same is true of the railways, but the comparison is complicated because of the variety of services the railways have on offer—some of which, like the passenger train parcels services, cater for fast delivery over long distances. By broadly averaging out over the types of services, there appears not to be a large difference between the railways and the road haulier except for the railways' worse 'tail' i.e. the undelivered portion after the third day. The latter is rather large relative to that of the other two forms of transport and it is possible that this 'tail' is the cause of the generalisation which is sometimes made that the railways' transit times are poor. But it may be that the relatively slow consignments occur on particular types of services or particular types of consignments. Also in some industries, slow transit time is perhaps unimportant. In general however this is the factor that lowers the railways overall performance regarding speed of delivery.

As regards the GPO, although some of its consignments do take up to three days for delivery, after taking into account the distances over which consignments are handled, it probably ranks highest of all modes of transport for speedy transit.

Table: 13 Transit time and mode of transport

Percentages

Delivery	Own road vehicle†	Road	Rail	GPO	All modes
Same day	59	33	9	47*	31
Next day	16	16	14		18
Second day after despatch	13	11	12	27	17
Third day	6	9	10	14	10
Subsequently	6	31	55	12	24
	100	100	100	100	100

Source: General Survey

*Includes some deliveries on the same day.

†Predominantly short haul traffic.

Damage and losses

Two reasons often suggested for users' preference for a particular mode of transport are freedom from losses and low incidence of damage. From the subjective assessments received in the main part of the present survey however it appears that these two factors have been overrated as determinants of choice of mode of transport. Taking total tonnage despatched as a measure of the importance of a respondent, the proportion of establishments which cited low damage or loss as first reason for choice of mode of transport amounted to only about 2 per cent of the total.* And the information obtained from the consignment sample on actual damage or losses incurred shows that out of 64,000 consignments on which the General Survey was based 188 were reported lost and out of 16,000 consignments for which the relevant information was available 151 were damaged, i.e. about 0.3 per cent and 1 per cent respectively.

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*On the other hand, we have argued that because shippers have allocated consignments to those modes of transport that are least likely to damage or lose them, these low incidences of damage and loss reflect shippers rational choices. If this is the case, damage and loss could still be an important influence on modal choice. For fuller discussion see pp. 5—6.

Table 14: Proportion of consignments damaged or lost, analysed by mode of transport

Percentages

Mode	Proportion damaged	Proportion lost
Own road vehicle	1.1	0.1
Customer collection	5.8	0.0
Road haulage	0.7	0.6
Rail	2.0	0.8
GPO	0.3	0.05
All modes	1.0	0.3

Source: General Survey

Incidence of damage can be expected to vary according to the commodity involved so that before a valid assessment can be made of one means of transport's record with respect to damage compared with another, the type of product most commonly consigned by each mode must be allowed for. After removing the influences of commodity, and indeed of regularity and consignment size since these also have a marginal influence on incidence of damage, the conclusion is that there is nothing to choose between road haulage and own account transport with regard to freedom from damage. The railways have a rather worse record than the other forms of inland transport with damaged consignments accounting for 2 per cent of all consignments handled. The postal services have the least number of damaged consignments.

Unlike damage, losses of consignments are not influenced by the type of commodity carried. The only factor that probably has some bearing on the risk of losing a consignment is its size, but even here the size has to be fairly large, i.e. over one ton, before the risk decreases significantly. Undoubtedly the biggest cause of variation between modes of transport in proportion of consignments lost is therefore the quality of service given by the modes themselves. The best, in terms of least losses, is the GPO's parcels service with about 0.05 per cent of all consignments reported lost. Transport on own account had 0.1 per cent reported lost, road haulage 0.6 per cent and rail 0.8 per cent.

After allowing for the propensity of smaller consignments to be lost more frequently than larger ones, the GPO still has the smallest proportion reported lost and own account transport has the next smallest. Road haulage's record is worse than rail for the small consignments of up to about half a ton, but for larger consignments rail's record becomes the worst. It seems to be a feature of road transport—haulage and own account—that losses of the large consignments of over one ton are extremely rare (none was reported in the present survey). Losses of consignments over one ton were reported for rail, but it is possible that some of the larger rail-borne consignments reported lost for the purpose of the present survey did in fact turn up at the consignee premises after the last interview had occurred with the consignor (who gave the information on numbers of consignments reported lost).

Table 15: Proportion damaged*, analysed by commodity

Commodity	%
Foodstuffs	1
of which, bacon, meat, fruit and veg. products	3
Crude materials	1½
Chemicals	½
of which, heavy chemicals and dyestuff	6
Building materials	4
Iron and steel	—
Non ferrous metals	—
Electrical goods	4
of which, radio and electronic equipment	2½
Transport vehicles and equipment	1½
Metal manufactures	½
Other manufactured goods	½
of which, paper and paper products	2½
All commodities	1

Source: General and Commodity Surveys. The all commodity figure is derived from the General Survey only, however.

*Includes spoilt

Special features relating to consignments

It has often been asserted that the service rendered by a form of transport constitutes not only the movement of goods between two points but also additional features such as delivery within a specified time or in a certain manner and even ancillary operations such as warehousing, collection of money or further orders from the consignee, and so on. Indeed, the case for some modes of transport has been made more from the point of view of these additional factors than the direct service of transporting. Thus, during the present survey, in order to throw more light on the nature of and importance attached to these factors, in addition to gathering information on the physical characteristics of the various consignments made, establishments were asked to indicate whether the consignment could be said to have one or more of six special features listed. The features were (a) the need for the vehicle or wagon to have a specialised body, for example, refrigerated, insulated, or otherwise specially equipped; (b) the transit occurred between two establishments which were situated in fairly close proximity to one another so that a 'production line' type of movement was occurring; (c) the movement was a purely local delivery; (d) the commodity involved was perishable; (e) the consignment was urgently required; (f) the name of the consignor was prominently displayed.

on the vehicle carrying the consignments; (g) an activity other than transport was coupled to the consignment's delivery, for example, servicing, installation, collection of orders etc.; (h) the load was an indivisible one which could not go by rail.

The results to this question indicate that a number of consignments had at least some special feature or other; some 60 per cent of the consignments included in the General Survey contained an entry against this section. On the other hand few consignments had more than one or two special features attached to them — the average number of features per consignment with a special feature was 1.8.

The most common feature indicated was the fact that the producer's name or the name of the product was displayed while the consignment was in transit; a third of all consignments were attributed with this characteristic. The only other features of importance were the urgent nature of the commodity (defined to mean more urgently required than usual) and that the consignment was moving for local delivery.

As may be expected, the relative importance of various features varied according to the means of transport used. Advertising while the consignment was in transit occurred very frequently only in 'C' licence transport, being a feature of over 80 per cent of all consignments handled by own transport compared with 14 per cent of those moved by the road haulier and 2 per cent by rail. Similarly, local delivery (defined as radius up to 25 miles) is an important feature only in 'C' transport, occurring on 52 per cent of all consignments by own transport (and customer collection, which was mainly in 'C' licensed vehicles). This proportion corresponds closely with the proportion of consignments by 'C' vehicles moving on hauls up to 25 miles (61 per cent, see Table 2, page 14). Urgent consignments however, although mainly a feature of 'C' transport, were also a fairly common feature of transport by public operators, road, rail and GPO, where they accounted for about 1 in 7 of all consignments handled.

Other fairly common features of consignments moving by transport on own account include perishable nature of the commodity and that the consignment was being transported between two establishments of the same firm, each occurring on about 1 in 7 of all consignments. On the other hand, contrary to previous belief, neither the need for a special vehicle body nor the need for an extra service were often attached to consignments moving by 'C' vehicles. Indivisible loads which cannot go by rail are also very infrequently made.

The proportion of consignments attributed with a special feature was much higher in own account transport than in public transport. Indeed, over 90 per cent of all consignments carried by 'C' vehicles had at least one feature listed compared with about 40 per cent of those carried by the road haulier, about 30 per cent of those handled by the GPO and about 20 per cent of the rail-borne ones. Moreover, the number of features listed on each consignment attributed with having a special feature was higher in 'C' transport; two or three features being indicated compared with one of two when the consignment was being carried by the road haulier and normally one when the movement was by GPO or rail.

In the case of carriage by public operators, as indicated above, the only special feature which was fairly frequently attached to a consignment was that it was required urgently, while local delivery and advertising were mentioned with equal frequency when the movement was by road haulage.

In summary therefore, apart from the display of the producer's name on the vehicle—which is a difficult feature of transport to evaluate if, indeed, it should be regarded as a special feature at all; and local delivery—which is a function of length of haul, only the urgency with which consignments are required emerges as a special feature of the transport of a significant number of consignments. All modes share in meeting this latter aspect of transportation, though 'C' licence transport rather more than professional operators.

Table 16: Number of consignments with special features as a percentage of all consignments carried by each mode*

Feature	Own Vehicle	Customer Collection	Road Haulier	Rail	G.P.O.	All Modes
Special body	6	1	3	2	—	3
Inter-establishment move	15	4	8	2	2	8
Local delivery	52	52	13	1	9	25
Perishable	14	2	1	—	—	5
Urgent	33	22	13	13	15	20
Advert.	82	42	14	2	4	34
Extra service	9	1	6	2	1	5
Indivisible load	3	1	3	—	—	3
Average number of features per consignment with a special feature	2.3	1.5	1.4	1.0	1.1	1.8

Source: General Survey

*The figures in this table do not add to 100% because more than one feature was often listed per consignment.

Use of containers and pallets

In manufacturing industry, taken as a whole, it would appear that in 1966 containers(*) were used on about 6 per cent of all consignments made, pallets were used on 4 per cent of all movements, while on about 5 per cent of consignments some other device was used.

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* Containerisation has been defined as the technique of using containers or boxes, built to standards and range of dimensions, into which goods are packed by a manufacturer and where they remain untouched until unpacked by the customer. The word has become common parlance and is frequently found in transport magazines and journals. This fact was relied upon during the present survey and a specific definition of what is and is not a 'container' was not given on the questionnaire; the respondent's commonsense in interpreting the question was heavily relied upon. This practice has proved satisfactory for all manufacturing activities except perhaps the foodstuffs group where, when the food is in its raw state, the task of defining containers becomes most difficult; e.g. how large or how sophisticated in construction does the conventional tea chest have to become before it is classed a 'container'? Nevertheless, despite classification difficulties, it is not believed that the results of the question on use of containers are seriously inaccurate even in the food industry.

One of the main influences on containerisation and palletisation appears to be the type of commodity involved. Size (weight) of consignment is also an important factor, but because of ability to bulk consignments, very small movements can be handled by these devices while there appears to be few constraints on their ability to handle medium sized and large consignments of up to 10 tons or more. In 1966, the most palletised commodities were chemicals and processed foodstuffs; the most containerised, building materials with metal manufactures second and foodstuffs third.

Since the various modes of inland transport have different shares in the total movement of particular commodities, comparisons of degree of containerisation or palletisation between modes tend mainly to reflect this factor rather than differences between modes in their adoption of special handling devices, although containerisation of loads is a feature of professional operators—road and rail—rather than own account transport.

Table 17: Containerised or palletised consignments as a percentage of all consignments

Commodity	Per cent containerised	Per cent palletised
Foodstuffs	8	8
Crude materials	5	2
Chemicals	1	11*
Building materials	15	4
Iron and steel	4	2
Non-ferrous metals	4	2
Electrical goods	5	1
Transport vehicles and equip.	5	5
Metal manufactures	12	—
Other manufactures	5	2
All commodities	6	4

Source: General Survey
*Sampling error large

Ownership of transport facilities

A question which is often asked is whether ownership of a transport facility such as a 'C' licence vehicle fleet or a rail wagon fleet is associated with a markedly different allocation of demand for other modes of transport, and it has been claimed that ownership of a 'C' fleet in particular precludes use of other transport media. Before an answer is given, however, it would be useful to illustrate how important this matter of ownership really is in terms of proportion of establishments which own a transport facility.

The survey results show that by far the most common transport facility owned by a firm is a 'C' licensed fleet, 82 per cent of the firms in the General

Survey owned such fleets. The vast majority of these fleets are however very small with two thirds having a total unladen weight of less than 10 tons and with only 4 per cent having a total unladen weight in excess of 100 tons. The proportion of large establishments (91 per cent) owning 'C' licensed fleets is much greater than for small establishments (73 per cent), but not significantly greater than for medium sized establishments (87 per cent), and the size of large establishments' fleets are as to be expected, also appreciably greater with only 36 per cent of the large establishments' fleets being less than 10 tons compared with 84 per cent and 70 per cent for small and medium sized establishments respectively.*

The influence of nature of business upon the probability of ownership of a 'C' fleet is not great but its influence upon the size of the fleet is very apparent with, for example, three-quarters of the establishments in the electronics industry owning fleets of less than 10 tons unladen weight compared with only one third in chemicals and foodstuffs even though the size of establishment is greater in electronics than in chemicals and very much greater than in foodstuffs.

A close substitute to owning vehicles is the use of 'C' licensed pools or 'C' hiring arrangements, but neither is common. Indeed, 'A' contract fleets are a more common alternative to owning vehicles except that 'alternative' is perhaps not the correct word since establishments rarely rely upon 'A' contract operation to the complete exclusion of owning own account transport fleets.

As regards rail sidings and ownership of railway wagons, the presence of rail sidings is relatively rare in most establishments except those in the iron and steel and chemicals industries and even in these industries the proportion is high (over 50 per cent) only in the larger establishments of 500 or more employees. The pattern of ownership of railway wagons is similar to that of railway sidings, i.e. only in the large establishments of the iron and steel and chemicals industries is ownership of this transport facility common—about one in four of such establishments owning wagons.

Given widespread ownership of 'C' licensed vehicles in all industries and of rail wagons and sidings in a few, specific, types of establishment, is their ownership associated with a different allocation of demand for transport? The answer is yes—but not markedly so. For example the proportion of traffic sent by main mode was about the same in an establishment owning a 'C' vehicle fleet as in those establishments that did not own a fleet. Similarly, where establishments owned railway wagons and/or were rail siding connected, although the proportion of total traffic sent by rail was greater than in a similar type of establishment without these facilities, it was not appreciably greater.

Indeed, one of the interesting results of the survey relates to the diversity of transport modes used by individual manufacturing establishments. One third of the establishments in the General Survey which gave information on transport expenditure sent, in fact, less than 60 per cent of their traffic by the most important mode they used while at the other end of the scale, less than one quarter of the establishments sent more than 90 per cent of their traffic by one mode.

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* Large establishments are defined as those with 500 or more employees, medium sized establishments as those with 100 to 499 employees and small establishments as those with less than 100 employees.

The use of a number of modes is rather more prevalent in the large and medium sized establishments than amongst the small establishments and whereas nature of business may at first appear to be an important factor in determining diversity of choice, it is the variation between industries in average size of establishments which is the fundamental cause rather than the nature of the goods produced.

Table 18: Proportion of total tonnage despatched which went by own vehicle in establishments owning such vehicles, analysed by size of establishment

Percentage of the establishments in each size group

Size (employees)	Proportion of total tonnage					Total	
	1—20%	21—40%	41—60%	61—80%	81—100%		*
Over 499	31	14	19	19	17	100	36
100-499	26	11	10	19	34	100	89
11-99	4	15	15	15	50	100	52
All sizes	20	13	14	18	35	100	177

Source: General Survey

*Number of establishments reporting

Table 19: Expenditure on main mode as percentage of total expenditure on transport, analysed by size of establishment.

Percentages of total establishments in each size group

Size (employees)	Expenditure on main mode as % of total					Total	
	1—20%	21—40%	41—60%	61—80%	81—100%		*
Over 499	—	9	22	43	26	100	42
100-499	8	7	21	32	32	100	126
11-99	1	5	23	19	52	100	87
All sizes	4	8	21	29	38	100	255

Source: General Survey

*Number of establishments reporting

The relative use made of the different modes of transport depends to a great extent upon the size of firm. Analysis of the five commodities in the Commodity Survey showed that (medium sized firms in the iron and steel industry the only exception) the larger the firm the less use, proportionally, is made of transport on own account, while, with the exception of electronics (for which quantities are very small) the larger the firm the greater, proportionally, is the use made of rail. A pattern in road haulage is also apparent with proportionally more use being made of this form of transport by medium sized establishments than small ones, and in the two instances (chemicals and iron and steel) where large firms made proportionally less use of road hauliers than medium sized firms, very large quantities are shipped by rail.

Thus, in global (as opposed to individual consignment) terms the pattern seems to be that where small quantities are involved frequent use is made of transport on own account, as the quantities increase more use is made proportionally of road haulage, and where very large annual tonnages are involved frequent use is made of rail. Also, small firms (generating small quantities) use rail as opposed to road haulage relatively more than medium sized firms.

Share of road in total transport

Previous surveys have already provided information on the share of road transport in inland freight transport (including coastwise shipping traffic) in Great Britain. For example, estimates based on the results of the 1962 survey of road goods transport showed that by 1966 road transport accounted for over 80 per cent of total transport demand measured in tons, and over 60 per cent measured in ton miles, of all economic activity. The present survey, which relates to manufacturing activity only, displays the share of road transport by yet another measure, i.e. individual consignments, and because of the frequency with which small consignments are made by many sectors of industry it is perhaps not surprising that own account transport ranks highest when its contribution is measured in this fashion and that the road haulier takes second place while the GPO ranks third—above rail and coastal shipping. The table below displays the varying shares of each mode depending on the method used to measure transport demand. Of all measures, expenditure on transport probably best takes into account all the various features which make up demand.

Table 20: Shares of each mode in total transport

Percentages

Mode	Total demand measured in terms of		
	Expenditure	Tons	Number of Consignments
Own road vehicle*	45	52	50
Road haulage	42	38	22
Rail	10	10	12
Coastal shipping	—	—	—
GPO	3	—	16
Inland waterways	—	—	—
Total	100	100	100

*Includes customer collection.

Source: General Survey.

Note: The share of each mode in total tons and ton miles generated by all industrial activity, i.e. including agriculture, mining, construction, distribution and services as well as manufacturing is as follows:—

Mode	Tons	Ton miles
Own road vehicle	49	29
Road haulage	34	32
Rail	12	22
Coastal shipping	3	16
Pipelines	2	1
Total	100	100

Source: MOT Surveys.

The use of rail transport

In addition to the information on use of rail transport shown by Chapter 1 it would be useful to know (a) which rail service is used for different types of consignment—whether, for example, freight liner, wagon load, parcels services and (b) what method of collection is employed to move the goods from the consignor's premises to the rail head. Information on (a) above is particularly relevant since there are different types of rail service and some are declining (some because of the railways' policy towards the service), others are growing.

In total some 8,000 consignments were moved by rail from the manufacturing plants covered by the General Survey (about 12 per cent of the total consignments generated by those establishments). Over three-quarters of the rail-borne movements were handled by the railways parcels services, i.e. parcel traffic by passenger train and sundries by freight train—some 4,000 consignments were handled by the former service, consisting almost entirely of finished manufactured goods; 2,500 by the latter, consisting of a wide range of commodities but predominantly of finished manufactures.

The most common size of parcel sent by passenger train was between 23 and 112 lbs, but smaller ones of up to 22 lbs and slightly larger ones of between 112 and 560 lbs were not uncommon. Few movements occurred of a size greater than 560 lbs however. The variation in consignment size sent by freight sundries service was much larger with some consignments being as light as 22 lbs, others weighing up to 1 ton or more; most, 86 per cent, were however in the 23 lbs to 560 lbs range.

The length of haul involved was extremely varied, ranging from less than 25 miles to over 300 miles in the case of both services, but predominantly it was in the 100 to 200 miles bracket with a peaking of consignments by passenger train in the 150-200 mile range and of freight sundries traffic in the 100-150 mile range.

Cost (to the manufacturer) of carriage was substantially higher by passenger train than by freight train service. On average, it cost threepence per lb to use the passenger train parcels service compared with one penny by freight train. On both services, there was considerable variation about the average depending on the weight of the consignment and the distance handled—cost increased with size and distance but not on a pro-rata basis, so that expressed in unit terms, i.e. cost per lb and per lb mile, the heavier the consignment or the longer the haul the lower the cost.

The next most often used rail service was full wagon traffic. Some 550 consignments were sent by this service, 7 per cent of all rail-borne consignments. They consisted mainly of iron and steel products, processed foods and manufactured fuels; little use was made of this type of rail service by other industries. Two thirds of the consignments were over 7½ tons in weight and the most common length of haul was between 100 and 150 miles.

Liner train services were used for about 300, 4 per cent, of the rail-borne consignments included in the General Survey, but freight liner services were in their infancy at the time the survey was being undertaken and the proportion is probably higher at the time of writing this report. Of the freight liner consignments picked up in 1966, all were of manufactured goods and a high proportion were of small consignments of up to 560 lbs; journey lengths were mainly over 300 miles.

Full train load traffic serving manufacturing industry was also in embryonic form at the time of the survey and the share in total consignments shown by the present results is probably an out-dated estimate.

Table 21: Use of types of rail service

Numbers of consignments

Commodity	Type of service							
	Parcels by Passenger Train	Freight Sundries	Full Wagon	(²) Liner	Full Train	Other	Total	
							No.	*
Foodstuffs	—	90	190	—	180(¹)	—	460	3
Crude materials	200	—	—	—	—	—	200	11
Chemicals	10	80	10	—	—	—	100	3
Building materials	30	50	10	—	—	—	90	3
Iron and steel	10	390	150	—	10	—	560	33
Non-ferrous metals	40	30	—	—	—	—	70	8
Electrical goods	220	270	—	10	—	—	500	16
Transport vehicles and equipment	150	150	—	10	—	—	310	12
Metal manufactures	180	190	—	—	—	—	370	12
Other manufactures†	3,280	1,250	190	280	—	10	5,010	20
All commodities	4,120	2,500	550	300	190	10	7,670	12

Source: General Survey
—Indicates less than 5
*Total by rail as % of total by all modes
†Including 170 consignments of manufactured fuel
(¹)Sampling error large.
(²)Including sundries traffic carried by liner services.

In addition to a choice of services when using rail transport, manufacturers could also choose between different methods of collection of their consignments for the journey to the rail-head. The latter choice is a limited one however; it is limited by (a) the absence of rail-siding connection and (b) the railway's own practices with regard to collection and delivery. The first restriction naturally precludes the use of a B.R. locomotive as a means of collecting a consignment from an establishment; the second means that the manufacturer, who is hiring the railway's services for all stages of the despatch is often not asked to choose between different methods of collection—this is done for him by railway management.

Given these conditions, the pattern of collection of consignments for carriage by the various rail services is very much as might be expected. For example, all consignments carried by the full train load service were collected from the manufacturer's establishment by B.R. loco and each of these establishments was therefore rail siding connected. Similarly, virtually all the full wagon traffic was moved to the rail-head by locomotive but, rather significantly, the few that were not consisted entirely of finished manufactured goods compared with the iron and steel products, manufactured fuel and processed foodstuffs which formed over 95 per cent of loco collected full wagon traffic. This pattern reflects the findings of the data collected about the characteristics of the establishments surveyed where the absence of rail siding connections to establishments producing finished goods is clearly illustrated and given that freight liner services are an alternative to full wagon services, the future full wagon traffics of British Rail will probably be confined to the relatively few rail siding connected industries. Since most of the latter industries are, at best, slow growing industries, the share of the full wagon service in B.R.'s total freight traffic will almost certainly decline.

The parcels services of B.R. were the most flexible with regard to methods of collection. Even on these services, however, B.R.'s own road vehicles were used on between 80 and 90 per cent of the consignments; the road haulier was hardly ever used and the manufacturer's own vehicle was only fairly commonly used for consignments going by passenger train.

General features of transport demand

(i) Consignment size.

Perhaps one of the most revealing general results of the present survey relates to the most frequent size of consignment despatched by British manufacturing industry. The average is 1¼-tons but this is of course a mid point of a wide range and the distribution of consignments between the various weight groups presents more meaningful information. This reveals that 50 per cent of all consignments made weighed less than 113 lbs, a further 30 per cent weighed between 113 and 2240 lbs, only about 20 per cent weighed more than a ton (2240 lbs) of which a fifth (4 per cent of all consignments) were over ten tons.(1)

Considerable variation occurs according to the commodity involved and whereas a relatively high proportion of consignments of iron and steel, building materials and chemicals were at the heavier end of the range (30-50 per cent over a ton), the proportion was very much less in the case of finished manufactured goods such as engineering and electrical products, metal goods, textiles, etc. Indeed, there is a fairly clear distinction in size of consignment between those industries that produce intermediate goods, i.e. products that form inputs of other industries, and those that produce for final demand. Amongst the latter industries size of consignment tends to be very small—over a third were less than 23 lbs and about two-thirds weighed less than 113 lbs—while amongst the former, consignments of all sizes up to 10 tons and more are not infrequent. Moreover, if it were possible to segregate those industries that produce purely for intermediate demand, for example as has been done in the Commodity Survey with the 'heavy' branch of the iron and steel industry (M.L.H.311), it is probable that a much more distinct concentration of consignments in the heavier weight groups in these industries would become apparent. It must be remembered that the categories of industries shown in Table 22 are fairly broad and the chemicals industry in particular covers a number of activities which produce for final demand, e.g. pharmaceutical and toilet preparations.

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[1] In tonnage terms, the proportions are naturally very different with consignments weighing less than 113 lbs accounting for only 1 per cent of total tonnage, those weighing from 113 to 2240 lbs 6 per cent, those weighing from 1 to 10 tons 51 per cent, while the relatively infrequent large consignments of over 10 tons accounted for 42 per cent of total tonnage despatched by manufacturing industry.

Table 22: Distribution of consignments by size (weight)

Per cent of total number of consignments of each commodity

Commodity	Weight group							Total
	Over Not over 22lbs	22 lbs 112 lbs	112 lbs 560 lbs	560 lbs 1 ton	1 ton 5 tons	5 tons 10 tons	10 tons	
Processed foods	..........55(1)..........			19	16	5	5	100
of which, bacon, meat and veg. products	31	25	18	12	9	2	3	100
Crude materials	11	33	16	14	10	10	6	100
Chemicals	40	8	11	8	8	8	17	100
of which, 'heavy' chem.	19	15	18	10	13	11	14	100
Building materials	4	18	19	14	13	24	8	100
Iron and steel	23	15	14	14	18	7	9	100
of which, steel	2	3	5	9	25	23	33	100
Non ferrous metals	34	27	20	9	9	1	—	100
Engineering and elec.	49	18	22	7	3	1	—	100
of which, electronics	51	18	14	7	7	2	1	100
Transport equipment	34	25	12	12	13	4	—	100
Metal manufactures	42	12	24	13	5	3	1	100
Other manufactures	36	35	18	5	5	1	—	100
of which, paper	28	25	20	10	10	4	3	100
All commodities	28	23	16	13	11	5	4	100

Source: General and Commodity Surveys. The all commodities figure is derived from the General Survey.

(1) Because of a number of small consignments for which precise weight not indicated, it has not been possible to allocate these between weight groups up to 560 lbs.

A more general and pertinent question that might be asked is why is it that apart from those industries producing for intermediate demand, manufacturing establishments consign in such small quantities? It is beyond the scope of the present survey to answer this question since it concerns not only attitudes towards stock-holding, capabilities for bulking consignments, etc., but also such fundamental issues as size of establishment, duration of production runs, and so on. It may even be inevitable that as an economy becomes more technologically advanced, the products of its industries become lighter in weight but, relative to their size, very high in value, for example, the electronics industry studied in the Commodity Survey despatched more than half its consignments in packages of less than 23 lbs.

Comparison with the situation in American industry indicates that British industry is not abnormal in this respect. Although the average size of consignment in most industries, and in manufacturing industry taken as a whole, is much larger in the U.S.A. than in Britain (probably because of differences in average size of plant) the difference in size of consignment of finished manufactures compared with intermediate products is the same in both countries. In other words, taking the average for all industry in each country as 1.0, the relative size of consignment in engineering and electrical goods production is 0.26 and 0.33 in Great Britain and U.S.A. respectively, and in 'other' manufacturing 0.30 and 0.30, respectively.

(ii) Length of haul.

A second main characteristic of transport demand is the distance over which consignments are made. Distance is obviously a function of a country's geography and of its industrial location pattern, so that the findings of the present analysis will mainly reflect the existing situation in Great Britain. They would probably be vastly different for another country e.g. the U.S.A., and even different in Britain if a major shift occurred away from traditional locations for industry—as the result of regional policies for example.

Given the present industrial concentrations, it is not surprising that over a third of consignments made by manufacturing industry were over distances of not more than 25 miles and a half were moved less than 50 miles. Short hauls were particularly common in the food processing and building materials industries, many of which presumably, serve local and not national markets. Medium hauls of 75 to 150 miles were not an important feature of any industry except iron and steel manufacture where a relatively high proportion of movements occurred in the 75-100 mile bracket, and engineering and electrical goods where a fifth of all consignments were over distances of 125-150 miles. Long hauls of over 150 miles were common in the chemicals, non-ferrous metals and metal manufacturing industries but very long hauls of 300 miles or more, a distance of from London to Scotland or the far South West, were not very numerous in any industry except metal manufactures.

Table 23: Distribution of consignments by length of haul

Per cent of total number of consignments of each commodity

Commodity	Haul						Total
	Over Not Over 25 miles	25 miles 50 miles	50 miles 100 miles	100 miles 150 miles	150 miles 200 miles	200 miles	
Processed foods	57	23	6	6	3	5	100
of which, bacon, meat and veg. products	45	19	12	6	3	15	100
Crude materials	25	7	24	17	13	14	100
Chemicals	6	20	22	11	20	21	100
of which, 'heavy' chem.	11	19	14	17	17	22	100
Building materials	59	18	7	4	4	8	100
Iron and steel	17	11	25	19	13	15	100
of which, steel	9	15	46	13	10	7	100
Non ferrous metals	13	5	9	19	17	37	100
Engineering & elec. goods	8	23	18	26	6	19	100
of which, electronics	16	17	27	19	9	12	100
Transport equipment	23	14	18	16	14	15	100
Metal manufactures	15	11	13	13	16	32	100
Other manufactures	32	11	16	15	11	15	100
of which, paper	15	25	13	11	15	21	100
All commodities	35	15	14	13	10	13	100

Source: General and Commodity Surveys. The all commodities figure is derived from the General Survey.

Thus, the broad pattern of industrial production in Britain may be summarized as follows. Foodstuffs and building materials industries serve mainly local markets and, since the former produces mainly for final demand, most establishments in the foodstuffs industry would seem to be located near the main centres of population(¹). The products of the iron and steel industry move over all distances in fairly equal proportion, suggesting a fairly wide scatter of the industries using these intermediate goods and also, of course, a fair geographical dispersion of iron and steel plants. Although the products of the chemicals, engineering and electrical goods, and transport equipment industries move over short and long distances, indicating either a fair dispersion of these activities, or of their customers, or both, only non-ferrous metals and manufactured metal goods were consigned mainly over long distances so that only in the latter industries can it be said that geographical dispersion, either of the industries or of their customers, is very marked. In fact it is the customers that are scattered since, as the results of the 1958 Census of Production shows, there is a very heavy concentration of the industries producing these goods in one part of the country—40 per cent of total employment in the non-ferrous metal and metal goods industries is in the Midland Region.(²)

Use of public transport at peak periods

It is sometimes said that operators of transport on own account do not keep sufficient capacity to meet peaks in demand and when such peaks occur make use of public carriers. The present results show however that although a fifth of the transport on own account operators in the General Survey did not have sufficient capacity to meet upward fluctuations in demand and use public carriers at such times, nearly a half of these were important users of public transport at off peak periods, while more than two-thirds used public carriers for 20 per cent or more of their total transport needs. This implies that the majority of manufacturers with their own fleets who use public carriers during peak periods also use them during off peak periods.

Past and planned changes of mode

Part of the questionnaire given to manufacturers contained questions on changes in the modes of transport they used and the results of this section show that 10 per cent of the establishments in the General Survey and 14 per cent in the Commodity Survey had had a major change (defined as a switch from one mode to another of 5 per cent or more of total tonnage shipped) in the mode of transport used during the two year period before the inquiry, i.e.

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[1] This is borne out by the results of the 1958 Census of Production which shows nearly half the employment in the Food, Drink and Tobacco industry to be concentrated in the South East, Midland and North West regions, which together account for 44 per cent of the population of Great Britain.

[2] In so far as the sample of establishments for the General Survey was geographically biased, the conclusions reached about the non ferrous and metal goods industries really apply to those branches of the industry outside the Midland Region. The same pattern may or may not be true of establishments in these industries in this latter region.

September 1964—September 1966, and 4 per cent and 6 per cent of establishments in the two surveys respectively had already planned major changes but had not at the time of the inquiry put them into operation. Within a comparatively short space of time therefore a substantial number of establishments had already effected or intended a change in the mode of transport they used. So not only do firms have, as previously noted, a considerable diversity in the modes they currently use, but there is also a constant changing between modes.

In both surveys there was no particular type of past change that was excluded but the moves from rail were however much more significant than any of the others. Moreover, although there had been a net movement from rail to road and the main movement had been in those industries which provided an insignificant part of rail traffic, the Commodity Survey showed that there had been net movements from rail to road hauliers in the two important (to rail) industry groups namely chemicals and iron and steel.

The *planned* changes on the other hand were in complete contrast to those that had already taken place. In the General Survey five of the fourteen establishments planning major changes were moving over to rail whilst no establishment was moving in the opposite direction and in the Commodity Survey nine of the twenty-one establishments planning changes were moving to rail while only three were planning moves in the opposite direction. These movements to rail are interesting because they feature some industries that because of the high risk of damage have always relied heavily upon transport on own account. Thus, although there are comparatively few observations to draw conclusions from, it nevertheless appears that there had been an important change in the attitude of manufacturers towards the railways.

The reasons for the changes are therefore interesting. The most important reason for the past changes from rail were slowness and delays, followed by losses and damage with increased rail charges falling into third place. In complete contrast, most of the planned changes over to rail were on account of the freight liner service.

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Ministry of Transport

Transport for Industry

(Summary Report)

A study of the determinants of demand for
transport in manufacturing industry conducted
for the Ministry of Transport by
B. T. BAYLISS and S. L. EDWARDS

London
Her Majesty's Stationery Office 1968

Digest

A study has been carried out of the use made of transport by manufacturing industry. This publication presents some of the more important findings and the results of certain statistical analyses, and a fuller report is to be published as soon as possible.

The inquiry was first planned in the latter part of 1965, and after preliminary investigations the main body of the data was collected in 1966 and 1967. Information was collected about the transport arrangements and the traffic despatched during one year by some 720 establishments in manufacturing industry. The firms included in the survey were asked to distinguish between the modes of transport used for the carriage of goods despatched from the establishments covered; namely road hauliers, road vehicles operated on own account, the General Post Office, the railways, canals and coastal shipping. It must be kept in mind that the railway services to which the figures relate were those available to traders in 1966 and 1967, when, for instance, freightliners were in their infancy.

Most firms used more than one mode of transport, and comparatively few, including those operating their own vehicles, were heavily committed to a single mode. For nearly half of the establishments the expenditure on the main mode was two-thirds or less of total expenditure on transport.

Short haul traffic, that is traffic on hauls of less than 50 miles, was dominated by road vehicles operated on own account. On long hauls of over 100 miles vehicles of this type still accounted for about one-sixth of all consignments but public road hauliers carry about twice as many.

The information about the relationship between the size of consignments and the mode of transport selected showed the overwhelming importance of road transport for consignments of all sizes. Traffic consigned by rail (other than G.P.O. traffic) accounted for about 12 per cent of all consignments, but this included 28 per cent of some small sizes of consignment (over 22 lbs but under 112 lbs) and about 13 per cent of large consignments of over 7½ tons.

A high proportion of consignments had special features, for instance, being perishable or urgent or needing special bodies on the vehicles. This was common in the case of traffic carried in vehicles operated on own account.

The survey obtained information about the costs to consignors of the modes of carriage selected and a supplementary investigation assembled data about the costs which would have been incurred if particular individual consignments had been despatched by other means. Of the firms covered by this supplementary investigation a proportion which varied between one-third and one-half according to the nature of the industry, knew the costs by alternative modes for some or all of the consignments about which they were asked. The questions put to firms were specific and tied to individual consignments: firms were not asked for instance, whether they had made a general investigation of the costs and other attractions of the various modes available to them. Moreover the study showed that in the vast majority of cases in which a firm used its own vehicles and did not know the cost by an alternative mode there were special features relating to the consignment that could well have meant that there was no feasible alternative to the shipper's own vehicles.

In the supplementary investigation well over one quarter of the consignments despatched by professional operators (road, rail, General Post Office, etc.) were sent by modes which were more expensive, in terms of the amount paid for the transport operation, than the cheapest alternative; nearly one-third of the consignments not sent by the cheapest mode were sent by a mode that was over 25 per cent more expensive than the cheapest alternative. Instances of the sending of consignments by other than the cheapest mode were not confined to any particular size of firm nor to the use of any specific mode of carriage.

Traders stressed that in their general transport requirements they attached great importance to ready availability and speed of service, and it therefore appeared that they were much influenced by considerations affecting other stages in the chain of production and distribution.

The general implication of these findings was reinforced by the results of the experimental application of a statistical probability analysis to the data produced by the survey. This analysis attempted to isolate the influence of each of the many factors affecting the distribution of traffic between the modes. The calculations indicated that on an average view, taken over consignments of all descriptions for which data were available, the effect of relative price on the mode of transport selected was small. This average no doubt covered certain categories of consignments which might switch readily from one mode of transport to another in response to changes in relative costs or prices, but the fact that the overall average was low indicates that such categories can only form a small part of the total. A large proportion of consignments was of such a nature—for example on short hauls or requiring special facilities—as severely to limit the possibility of switching to another mode.

This technique of analysis also illustrated the very important bearing which the length of haul had on the distribution of traffic between the modes, the short haul traffic generally being carried by vehicles operated on own account and the share of professional operators increasing as the hauls lengthen. The analysis suggested however that the length of haul only had a comparatively small relevance in the choice between road haulier and rail, with rail slightly favoured for very long hauls.